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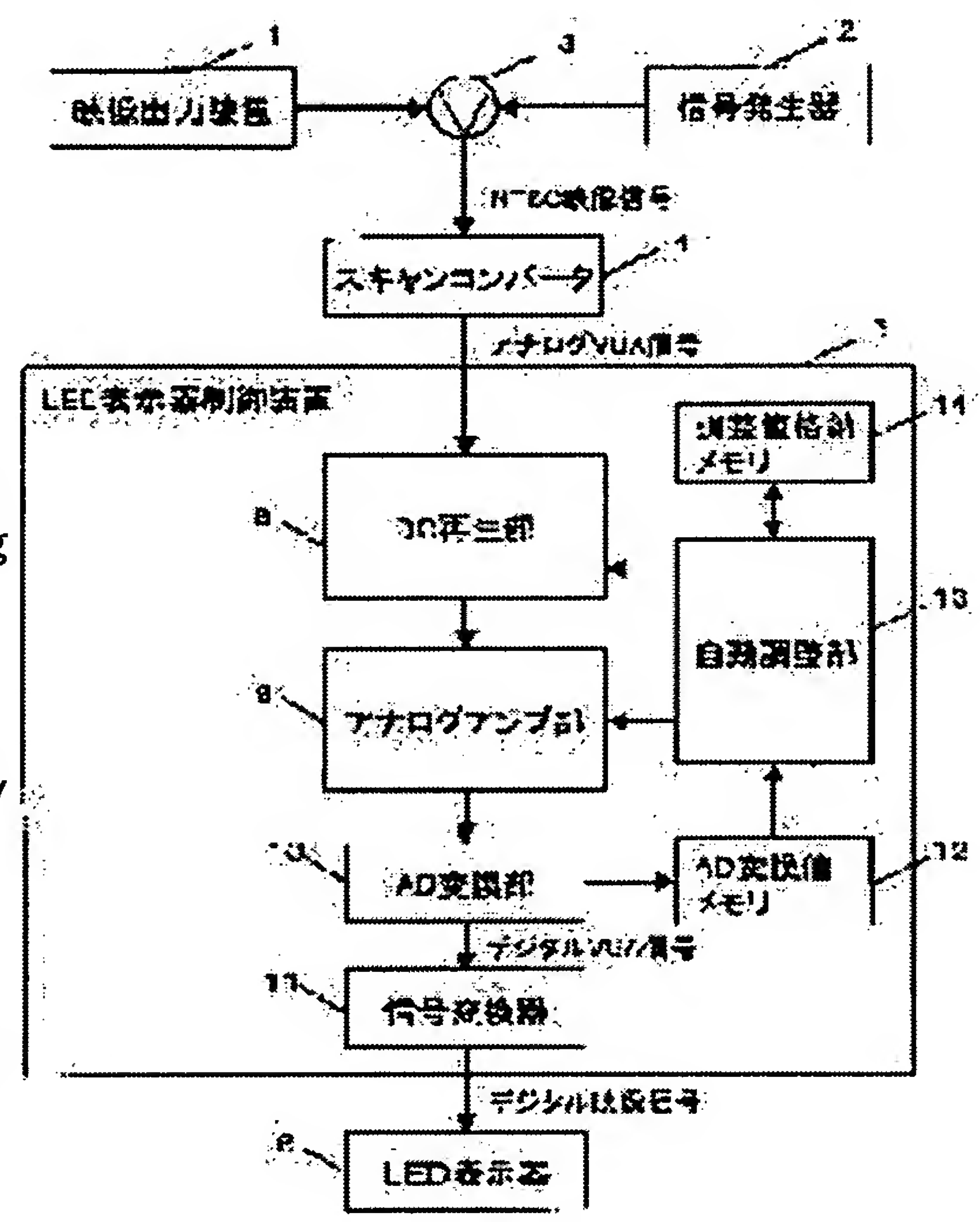
(54) CONTROLLER FOR LED DISPLAY UNIT

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a controller for an LED display unit which easily and accurately adjusts a DC level and a gain without adjustment errors.

SOLUTION: The controller 5 for the LED display unit includes: a DC reproducing part 8 for setting the DC level of an analog image signal to a predetermined level; an analog amplifier part 9 for amplifying the analog image signal in which the DC level is set by the DC reproducing part 8 by using a predetermined gain; an AD converting part 10 for converting the analog image signal amplified by the analog amplifier part 9 into a digital image signal; and an automatic adjustment part 13 which automatically adjusts the DC level of the DC reproducing part 8 so that the central level of the analog image signal outputted from the DC reproducing part 8 becomes the medium value of the range of the AD converting part 10, and automatically adjusts the gain of the analog amplifier part 9 so that the maximum range width of the analog image signal outputted from the analog amplifier part 9 is equalized to the range width of the AD converting part 10.



CLAIMS

[Claim(s)]

[Claim 1]A LED display device control device which changes an analog video signal corresponding to each trichromatic color into a digital video signal for displaying an image by a LED display device, comprising:
DC regenerating section which sets DC levels of said analog video signal as a predetermined level.
An analog amplifier part which amplifies an analog video signal with which DC levels were set up by said DC regenerating section by a predetermined gain.
An AD translation part which changes into a digital video signal an analog video signal amplified in said analog amplifier part.
While adjusting DC levels of said DC regenerating section automatically so that a central level of an analog video signal outputted from said DC regenerating section may become the median of a range of said AD translation part, An automatic regulation part which adjusts a gain of said analog amplifier part automatically so that it may become equal to maximum range width of an analog video signal outputted from said analog amplifier part, and range widths of said AD translation part.

[Claim 2]Set up DC levels of said DC regenerating section, and said automatic regulation part ranks second so that a maximum level of said analog video signal may serve as the maximum of a range of said A/D converter, By repeating operation of setting up a gain of said analog amplifier part so that a minimum level of said analog video signal may serve as the minimum of a range of said A/D converter, Or set up DC levels of said DC regenerating section, and it ranks second so that a minimum level of said analog video signal may serve as the minimum of a range of said A/D converter, By repeating operation of setting up a gain of said analog amplifier so that a maximum level of said analog video signal may serve as the maximum of a range of said A/D converter, The LED display device control device according to claim 1 adjusting automatically DC levels of said DC regenerating section, and a gain of said analog amplifier part.

[Claim 3]Bisect an analog video signal inputted into said DC regenerating section, and it has a waveform processing section which generates a division video signal which consists of a portion only more than DC levels of said analog video signal, or below DC levels, Said automatic regulation part so that a central level of an analog video signal which is the maximum or the minimum of said division video signal, and the median of a range of said AD translation part may be in agreement, So that it may become equal to the minimum of an analog video signal or a maximum level which is the minimum or the maximum of said division video signal outputted from said analog amplifier part, and range widths of said AD translation part after adjusting DC levels of said DC regenerating section automatically, The LED display device control device according to claim 1 adjusting a gain of said analog amplifier part automatically.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention relates to the LED display device control device which controls the level difference of the signal of R [of the picture image data inputted into an LED full color display], G, and B each color.
[0002]
[Description of the Prior Art]In recent years, the LED display device using the light emitting diode (henceforth "LED") of red (R) green (G) blue (B) of full color correspondence is beginning to spread quickly. This LED display device is used as a display on which the video signal of the NTSC system which various image output units, such as a television tuner, a videocassette recorder, a laser disc (registered trademark) player, and a video camera, output is generally displayed. The NTSC video signal outputted from these image output units is changed into the digital video signal corresponding to each color of R, G, and B by the LED display device control device, and is inputted into a LED display device, and an image is displayed on a LED display device.
[0003]Drawing 5 is a block diagram of the conventional LED display device control device.
[0004]In drawing 5, the image output units 1 are image output units, such as a television tuner, a videocassette recorder, a laser disc player, and a video camera. The signal generator 2 generates and outputs the signal for adjustment for the DC levels of the LED display device control device 20, and a gain adjustment. The mixed branching filter 3 is constituted by the directional coupler. The scan converter 4 divides into the chrominance signal C and the luminance signal Y the video signal of the NTSC system inputted from the image output unit 1 or the signal generator 2 through the mixed branching filter 3, and performs the color adjustment of hue, brightness, and chroma saturation. The chrominance signal C is divided into color-difference-signal R-Y (U) and B-Y(V) after that. After analog-to-digital conversion (henceforth a "AD translation") of these signals is carried out, scaling of them is carried out to an effective display area, they are changed into digital one R and G and B signal, and analogue conversion is carried out to the last, and they are outputted as an analog VGA signal of R, G, and B.
[0005]The LED display device control device 20 changes into the digital video signal corresponding to each color of R, G, and B the analog VGA signal of R, G, and B inputted from the scan converter 4. LED display device 6 is the display in which LED of much R, G, and B each color was arranged.
The digital video signal corresponding to each color of R, G, and B which are inputted is displayed as full color video.

[0006]The LED display device control device 20 comprises the DC regenerative circuit 21, the analog amplifier circuit 22, AD conversion circuit 23, and the signal converter 24. The DC regenerative circuit 21 is a circuit which performs DC-levels adjustment of the analog VGA signal inputted from the scan converter 4.
Resistance can be changed according to the angle of rotation of the knob of the volume 21a for DC-levels adjustment, and the DC levels of the analog VGA signal outputted from the DC

regenerative circuit 21 by this are made variable.
The analog amplifier circuit 22 is a circuit which performs gain level adjustment of the analog VGA signal with which adjustment of DC levels was performed in the DC regenerative circuit 21. Resistance can be changed according to the angle of rotation of the knob of the volume 22a for gain adjustments, and the gain (amplification factor) of the analog VGA signal outputted from the analog amplifier circuit 22 by this can be made variable.
AD conversion circuit 23 quantizes the analog VGA signal with which DC-levels adjustment and a gain adjustment were carried out by the DC regenerative circuit 21 and the analog amplifier circuit 22, and changes it into a digital VGA signal. The signal converter 24 changes a digital VGA signal into the digital video signal corresponding to each color of R for LED display devices, G, and B.
[0007]In the conventional LED display device control device of the above composition, some errors arise with dispersion in the characteristic of the scan converter 4 actually in the DC levels and amplitude of each analog VGA signal of R, G, and B. Therefore, dispersion in average value produces the digital VGA signal outputted from an AD conversion circuit between R, G, and B signal by the error of the DC levels of each of this analog VGA signal. Dispersion produces the digital VGA signal outputted from an AD conversion circuit in amplitude value between R, G, and B signal by the error of the amplitude of each analog VGA signal.
[0008]Drawing 6 is a figure explaining the correcting method of the error of an analog VGA signal, drawing 6 (a) expresses an example of the analog VGA signal before amendment with error, drawing 6 (b) expresses the digital VGA signal before amendment with error, and drawing 6 (c) expresses the analog VGA signal after amendment with error.
[0009]In drawing 6, the rectangular wave signal of the repetition by maximum luminance and minimum luminance (black level) is inputted as a signal for adjustment from the signal generator 2 as an example. D_i+P_i in drawing 6 The maximum brightness value of an analog VGA signal, D_i-P_i is a minimum luminance value of an analog VGA signal, D_i is the median of an analog VGA signal, and, as for the range maximum of AD conversion circuit 23, and D-P, the range minimum of AD conversion circuit 23 and D of D+P are the range median of AD conversion circuit 23.
[0010]In the example of drawing 6 (a), since maximum brightness value D_i+P_i of the analog VGA signal is over range maximum D+P of AD conversion circuit 23, all the portions into which the digital VGA signal exceeded D+P like drawing 6 (b) serve as D+P. Since minimum luminance value D_i-P_i of an analog VGA signal is larger than range minimum D-P of AD conversion circuit 23, the range of the low of AD conversion circuit 23 is not used effectively. Since range-widths $2P_i$ of the luminance value of an analog VGA signal differs from the range widths 2P of AD conversion circuit 23, dispersion may produce the digital VGA signal outputted from an AD conversion circuit in amplitude value between R, G, and B signal.
[0011]Then, in order to amend the error of these each analog VGA signal, DC regenerative circuit is equipped with the volume 21a for DC-levels adjustment about each of each analog VGA signal of R, G, and B.
The analog amplifier circuit 22 is equipped with the volume 22a for gain level adjustment about each of each analog VGA signal of R, G, and B.

[0012]Amendment of the error of each analog VGA signal is performed in the following procedures.
[0013]First, generate the signal for adjustment with the signal generator 2, and this signal for adjustment is inputted into the scan converter 4, The analog VGA signal outputted from the scan converter 4 is inputted into the DC regenerative circuit 21 and the analog amplifier circuit 22, and the amplified analog VGA signal (signal in the point A of drawing 5) which is outputted from the analog amplifier circuit 22 to each signal of R, G, and B is measured with an oscilloscope. The signal (for example, a rectangle signal and a saw-tooth-wave signal) with which the luminosity of each color consists of a repetition by the portion used as the portion used as the maximum and the minimum (black level) is used for this signal for adjustment.

[0014]A tuning company observes the waveform of an oscilloscope and calculates the wave-like median Di from an input waveform. And observing the waveform of an oscilloscope, a tuning company turns the volume 21a for DC-levels adjustment, and adjusts resistance so that the median Di of an input waveform may be in agreement with the conversion midrange value D of an AD conversion circuit. The maximum and the minimum of an analog VGA signal which are outputted from the analog amplifier circuit 22 and which were amplified adjust the gain of the analog amplifier circuit 22 so that it may become the maximum of the conversion range of AD conversion circuit 23, and the minimum. A tuning company performs this adjustment by turning the volume 22a for gain adjustments, observing the waveform of an oscilloscope.
[0015]Thus, maximum brightness value D_i+P_i of an analog VGA signal and minimum luminance value D_i-P_i which are outputted from the analog amplifier circuit 22 to each signal of R, G, and B and which were amplified, It is adjusted so that it may be in agreement with range maximum D+P and range minimum D-P of AD conversion circuit 23, and amendment of the error by dispersion in the characteristic of the scan converter 4 is performed.
[0016]
[Problem(s) to be Solved by the Invention]However, while the tuning company observed the waveform of the oscilloscope in the above-mentioned conventional LED display device control device, the volume 21a for DC-levels adjustment and the volume 22a for gain adjustments needed to be adjusted, and tuning was troublesome. In order that the tuning company might memorize the range D of the conversion range of AD conversion circuit 23, D+P, and D-P at the time of adjustment of each volume, there was a problem that tuning was troublesome and workability was also missing. Since the adjustment value was saved by the volume 21a for DC-levels adjustment, and the volume 22a for gain adjustments, there was also a problem that an adjustment value might change with vibration. The range of the conversion range of AD conversion circuit 23 was not fixed correctly with a device according to the manufacture error of AD conversion circuit 23, etc., but also had the problem that it could not adjust to dispersion in the range of the conversion range of AD conversion circuit 23 depending on the above-mentioned conventional adjustment procedure.
[0017]Then, the technical problem of this invention is in solving the above-mentioned conventional problem, and there is in providing a LED display device control device without an alignment error [in / it is possible to perform adjustment of DC levels and a gain easily and correctly and / these adjustments].
[0018]
[Means for Solving the Problem]In order to solve an aforementioned problem a LED display device control device of this invention, It is a LED display device control device which changes an analog video signal corresponding to each trichromatic color into a digital video signal for displaying an image by a LED display device, DC regenerating section which sets DC levels of said analog video signal as a predetermined level, An analog amplifier part which amplifies an analog video signal with which DC levels were set up by said DC regenerating section by a predetermined gain, An analog video signal amplified in said analog amplifier part so that a central level of an analog video signal outputted from an AD translation part changed into a digital video signal and said DC regenerating section may become the median of a range of said AD translation part, While adjusting DC levels of said DC regenerating section automatically, composition of providing an automatic regulation part which adjusts a gain of said analog amplifier part automatically is comprised so that it may become equal to maximum range width of an analog video signal outputted from said analog amplifier part, and range widths of said AD translation part.
[0019]By this composition, a LED display device control device without an alignment error [in / it is possible to perform adjustment of DC levels and a gain easily and correctly, and / these adjustments] can be provided.
[0020]
[Embodiment of the Invention]The LED display device control device of this invention according to claim 1, It is a LED display device control device which changes the analog video signal

corresponding to each trichromatic color into the digital video signal for displaying an image by a LED display device, DC regenerating section which sets the DC levels of said analog video signal as a predetermined level, The analog amplifier part which amplifies the analog video signal with which DC levels were set up by said DC regenerating section by a predetermined gain, The analog video signal amplified in said analog amplifier part so that the central level of the analog video signal outputted from the AD translation part changed into a digital video signal and said DC regenerating section may become the median of the range of said AD translation part, So that it may become equal to the maximum range width of the analog video signal outputted from said analog amplifier part, and the range widths of said AD translation part while adjusting the DC levels of said DC regenerating section automatically, In order that it may have composition possessing the automatic regulation part which adjusts the gain of said analog amplifier part automatically and an automatic regulation part may adjust automatically the DC levels of DC regenerating section, and the gain of said analog amplifier part by this composition, It becomes unnecessary for a tuning company to perform adjustment of DC levels and a gain using an oscilloscope, and work becomes easy. In order not to use volume, DC levels and the preset value of a gain are not out of order by vibration of apparatus. Adjustment of DC levels and a gain is attained correctly not related at dispersion by the individual difference of the conversion range by the side of the analog of an AD translation part.

[0021]The invention according to claim 2 is the LED display device control device according to claim 1, and said automatic regulation part, Set up the DC levels of said DC regenerating section, and it ranks second so that the maximum level of said analog video signal may serve as the maximum of the range of said A/D converter, By repeating operation of setting up the gain of said analog amplifier part so that the minimum level of said analog video signal may serve as the minimum of the range of said A/D converter, Or set up the DC levels of said DC regenerating section, and it ranks second so that the minimum level of said analog video signal may serve as the minimum of the range of said A/D converter, By repeating operation of setting up the gain of said analog amplifier so that the maximum level of said analog video signal may serve as the maximum of the range of said A/D converter, It supposes that the DC levels of said DC regenerating section and the gain of said analog amplifier part are adjusted automatically, and this composition enables an automatic regulation part to adjust automatically the DC levels of DC regenerating section, and the gain of said analog amplifier part.

[0022]The invention according to claim 3 is the LED display device control device according to claim 1, Bisect the analog video signal inputted into said DC regenerating section, and it has a waveform processing section which generates the division video signal which consists of a portion only more than the DC levels of said analog video signal, or below DC levels, Said automatic regulation part so that the central level of the analog video signal which is the maximum or the minimum of said division video signal, and the median of the range of said AD translation part may be in agreement, So that it may become equal to the minimum of an analog video signal or the maximum level which is the minimum or the maximum of said division video signal outputted from said analog amplifier part, and the range widths of said AD translation part after adjusting the DC levels of said DC regenerating section automatically, It supposes that the gain of said analog amplifier part is adjusted automatically, and this composition enables an automatic regulation part to adjust automatically the DC levels of DC regenerating section, and the gain of said analog amplifier part.

[0023]The 1 embodiment of this invention is described below, referring to drawings.

[0024](Embodiment 1) Drawing 1 is a block diagram of the LED display device control device concerning the embodiment of the invention 1.

[0025]In drawing 1, the image output units 1 are image output units, such as a television tuner, a videocassette recorder, a laser disc player, and a video camera. The signal generator 2 generates and outputs the signal for adjustment for the DC levels of the LED display device control device 5, and a gain adjustment. The mixed branching filter 3 is constituted by the directional coupler. The scan converter 4 divides into the chrominance signal C and the luminance signal Y the video signal of the NTSC system inputted from the image output unit 1 or the signal generator 2 through the mixed branching filter 3, and performs the color adjustment of hue, brightness, and

chroma saturation. The chrominance signal C is divided into color-difference-signal R-Y (U) and B-Y(V) after that. After analog-to-digital conversion (henceforth a "AD translation") of these signals is carried out, scaling of them is carried out to an effective display area, they are changed into digital one R and G and B signal, and analogue conversion is carried out to the last, and they are outputted as an analog VGA signal of R, G, and B.

[0026]The LED display device control device 5 changes into the digital video signal corresponding to each color of R, G, and B the analog VGA signal (analog video signal) of R, G, and B inputted from the scan converter 4. LED display device 6 is the display in which LED of much R, G, and B each color was arranged, and displays the digital video signal corresponding to each color of R, G, and B which are inputted as full color video.

[0027]The LED display device control device 5 comprises the DC regenerating section 8, the analog amplifier part 9, the AD translation part 10, the signal converter 11, the AD translation value memory 12, the automatic regulation part 13, and the adjustment value storing memory 14. The DC regenerating section 8 performs DC-levels adjustment of the analog VGA signal inputted from the scan converter 4. By the DC regenerating section 8, the analog amplifier part 9 performs gain level adjustment of the analog VGA signal with which adjustment of DC levels was performed, and by AGC (variable gain amplifier). The gain (amplification factor) of the analog VGA signal outputted from the analog amplifier part 9 can be made variable. The AD translation part 10 quantizes the analog VGA signal with which a gain adjustment and DC-levels adjustment were carried out by the DC regenerating section 8 and the analog amplifier part 9, and changes it into a digital VGA signal (analog video signal). The signal converter 11 changes a digital VGA signal into the digital video signal for a display corresponding to each color of R for LED display devices, G, and B.

[0028]The AD translation value memory 12 stores the value of the digital VGA signal outputted from the AD translation part 10. Based on the value of the digital VGA signal stored in the AD translation value memory 12, the automatic regulation part 13 the central level of the analog video signal outputted from the DC regenerating section 8 so that it may become the median of the range of the AD translation part 10, While adjusting the DC levels of the DC regenerating section 8 automatically, the gain of the analog amplifier part 9 is adjusted automatically so that it may become equal to the maximum range width of an analog video signal and the range widths of the AD translation part 10 which are outputted from the analog amplifier part 9. The adjustment value storing memory 14 is a memory which stores the DC levels of the DC regenerating section 8 and the gain of the analog amplifier part 9 which the automatic regulation part 13 set up, and nonvolatile memory, such as a flash memory, is used.

[0029]In the LED display device control device of this embodiment constituted as mentioned above, the operation is explained hereafter.

[0030]First, let operation setting of the automatic regulation part 13 be adjustment mode at the time of adjustment of the DC levels of the DC regenerating section 8, and the gain of the analog amplifier part 9. Next, the NTSC video signal of 100% of white is made to output from the signal generator 2. This NTSC video signal is changed into an analog VGA signal by the scan converter 4, and is inputted into the DC regenerating section 8 of the LED display device control device 5.

[0031]Drawing 2 is a figure explaining the correcting method of the error of the analog VGA signal in Embodiment 1, and drawing 2 (a) expresses an example of the analog VGA signal of 100% of white before error correction. D_i+P_i in drawing 2 The maximum brightness value of an analog VGA signal, D_i-P_i is a minimum luminance value of an analog VGA signal, D_i is the median of an analog VGA signal, and, as for the range maximum of the AD translation part 10, and D-P, the range minimum of the AD translation part 10 and D of D+P are the range median of the AD translation part 10.

[0032]As the analog VGA signal of 100% of white is shown in drawing 2 (a), a level serves as a signal of the constant value of D_i+P_i.

[0033]The automatic regulation part 13 sets the DC levels of the DC regenerating section 8, and the gain of the analog amplifier part 9 as a default value first. After DC-levels adjustment and signal amplification are carried out by the DC levels and the gain which were set up, in the AD

translation part 10, the AD translation of the analog VGA signal is carried out by them, and this value is stored in the AD translation value memory 12.
[0034]When level D_i+P_i of the analog VGA signal inputted into the DC regenerating section 8 is larger than maximum D+P of the range of an A/D converter at this time, The value of the digital VGA signal outputted from the AD translation part 10 is the maximum M of the output of an A/D converter (for example, when the AD translation part 10 quantizes at 8 bits.). Become the maximum 255 and when level D_i+P_i of an analog VGA signal is smaller than maximum D+P of the range of an A/D converter, The value of the digital VGA signal outputted from the AD translation part 10 turns into a value which quantized level D_i+P_i by the quantization level of the AD translation part 10.
[0035]Next, the automatic regulation part 13 reads the data stored in the AD translation value memory 12. If the read value is less than the maximum M of the output of an AD translation, the automatic regulation part 13 is set up raise the DC levels of the DC regenerating section 8, and it will raise the DC levels of the DC regenerating section 8 until the value of the digital VGA signal eventually outputted from the AD translation part 10 turns into the maximum M of the output of an AD translation.
[0036]On the other hand, if the read value is the maximum M of the output of an AD translation, the automatic regulation part 13, It sets up lower the DC levels of the DC regenerating section 8, and the value of the digital VGA signal eventually outputted from the AD translation part 10 drops the DC levels of the DC regenerating section 8 to this side in which less than the maximum M of the output of an AD translation becomes.
[0037]Drawing 2 (b) expresses the analog VGA signal of 100% of white after error correction. Maximum level D_i+P_i of after [the end of the above-mentioned adjustment] of an analog VGA signal corresponds with maximum D+P of the range of the AD translation part 10.
[0038]Next, the NTSC signal of a gradation pattern is made to output from the signal generator 2. This NTSC video signal is changed into an analog VGA signal by the scan converter 4, and is inputted into the DC regenerating section 8 of the LED display device control device 5. After DC-levels adjustment and signal amplification are carried out by the DC levels and the gain which were set up, in the AD translation part 10, the AD translation of the analog VGA signal is carried out by them, and this value is stored in the AD translation value memory 12.
[0039]The digital VGA signal after drawing 2 (c) carried out an example of the analog VGA signal of the gradation pattern before a gain adjustment and drawing 2 (d) carries out the AD translation of the analog VGA signal of drawing 2 (c) is expressed. As shown in a figure, when the gain of the analog amplifier part 9 has not been adjusted, when minimum D_i-P_i of an analog VGA signal is smaller than minimum D-P of the range of the AD translation part 10, When distortion arises to a digital VGA signal and minimum D_i-P_i of an analog VGA signal and minimum D-P of the range of the AD translation part 10 are not in agreement, imbalance arises in the luminosity of each color of R, G, and B, and reappearance of an exact color cannot be performed.
[0040]Next, the automatic regulation part 13 reads the data stored in the AD translation value memory 12. If the minimum of the read value is a larger value than 0, the automatic regulation part 13 is set up raise the gain of the analog amplifier part 9, and it will raise the gain of the analog amplifier part 9 until the minimum of the digital VGA signal eventually outputted from the AD translation part 10 is set to 0.
[0041]On the other hand, if the minimum of the read value is 0, the automatic regulation part 13 will be set up lower the gain of the analog amplifier part 9, and will drop the gain of the analog amplifier part 9 to this side where the value of the digital VGA signal eventually outputted from the AD translation part 10 becomes one or more.
[0042]Adjustment is ended by repeating adjustment of the DC levels of the above DC regenerating sections 8, and an automatic regulation of the gain of the analog amplifier part 9 several times. Drawing 2 (e) is a figure showing the analog VGA signal after that of adjustment of the DC levels of the DC regenerating section 8 and the gain of the analog amplifier part 9 is

completed, Maximum D_i+P_i of an analog VGA signal and minimum D_i-P_i of after [adjustment] of an analog VGA signal correspond with maximum D+P of the range of the AD translation part 10, and minimum D-P, respectively.
[0043]After the above-mentioned adjustment is completed, the automatic regulation part 13 stores in the adjustment value storing memory 14 the DC levels of the DC regenerating section 8 and the gain of the analog amplifier part 9 which were adjusted. And in inputting an NTSC video signal from the actual image output unit 1. Operation setting of the automatic regulation part 13 is made into non-adjustment mode, the DC levels and the gain which were stored in the adjustment value storing memory 14 are set as the DC regenerating section 8 and the analog amplifier part 9, and it is made to perform DC-levels conversion and amplification of an analog VGA signal.
[0044]As mentioned above, according to the LED display device control device of this embodiment, dispersion can be controlled by adjusting the analog VGA signal of R, G, and B with dispersion with the characteristic of the scan converter 4 automatically. Since the digital VGA signal with which dispersion in the level of R, G, and B was controlled is inputted into the signal converter 11, it is changed into the digital video signal for LED display devices and picture image data is displayed on LED display device 6, it becomes possible to perform a quality display. In order that it is not necessary to use an oscilloscope for adjustment of the DC levels of the DC regenerating section 8, and adjustment of the gain of the analog amplifier part 9 and the automatic regulation part 13 may carry out, these adjustments are simplified dramatically and it becomes possible to perform these adjustments for a short time. The DC levels and the gain which were adjusted are stored in the adjustment value storing memory 14 which is nonvolatile memory, In order that these values stored in the adjustment value storing memory 14 may be read also at the time of power supply starting and it may set them as the DC regenerating section 8 and the analog amplifier part 9 next time, Like the conventional volume, a value does not change by vibration of apparatus and it becomes possible to perform display control of the LED display device which is always stabilized and does not have a gap in a color tone. Regardless of the individual difference (dispersion) of the conversion range of an AD translation part, exact adjustment of DC levels and a gain is attained.
[0045]Although it had composition which the automatic regulation part 13 adjusts DC levels using the analog VGA signal of 100% of white first, and uses the analog VGA signal of a gradation pattern next, and adjusts a gain in this embodiment, The automatic regulation part 13 is good also as composition which adjusts a gain using the analog VGA signal of 100% of white first, uses the analog VGA signal of a gradation pattern next, and adjusts DC levels. Even if it has such composition, adjustment of DC levels and a gain level can be automatically performed like an above-mentioned case.
[0046](Embodiment 2) Drawing 3 is a block diagram of the LED display device control device concerning the embodiment of the invention 2.
[0047]In drawing 3, 1 an image output unit and 2 a signal generator and 3 A mixed branching filter, 4 a scan converter and 5 a LED display device control device and 6 A LED display device, Since an automatic regulation part and 14 are [an analog amplifier part and 10] adjustment value storing memories an AD translation value memory and 13 an AD translation part and 11 DC regenerating section and 9 as for a signal converter and 12 and 8 of these is the same as that of drawing 1, a same sign is attached and explanation is omitted.
[0048]In this embodiment, the waveform processing section 7 halves the analog VGA signal inputted with DC levels, and generates the division video signal which consists of a portion only below the DC levels of an analog VGA signal.
[0049]In the LED display device control device of this embodiment constituted as mentioned above, the operation is explained hereafter.
[0050]First, let operation setting of the automatic regulation part 13 be adjustment mode at the time of adjustment of the DC levels of the DC regenerating section 8, and the gain of the analog amplifier part 9. First, the automatic regulation part 13 sets the DC levels of the DC regenerating section 8, and the gain of the analog amplifier part 9 as a default value, and makes the waveform

processing section 7 an operating state. Next, the NTSC video signal of monochrome fringe patterns is made to output from the signal generator 2. This NTSC video signal is changed into an analog VGA signal by the scan converter 4, and is inputted into the DC regenerating section 8 of the LED display device control device 5.

[0051]Drawing 4 is a figure explaining the correcting method of the error of the analog VGA signal in Embodiment 2, and drawing 4 (a) expresses an example of the analog VGA signal of monochrome fringe patterns before error correction. D_i+P_i in drawing 4 The maximum brightness value of an analog VGA signal, D_i−P_i is a minimum luminance value of an analog VGA signal, D_i is the median of an analog VGA signal, and, as for the range maximum of the AD translation part 10, and D−P, the range minimum of the AD translation part 10 and D of D+P are the range median of the AD translation part 10.

[0052]As shown in drawing 4 (a), as for the analog VGA signal of monochrome fringe patterns, a level serves as a rectangular wave signal with which D_i+P_i and a level consist of a repetition of 2 level with D_i−P_i. In an operating state, the waveform processing section 7 halves this analog VGA signal inputted with DC levels, and generates the division video signal which consists of a portion only below the DC levels of an analog VGA signal. After DC−levels adjustment and signal amplification are carried out by the DC levels and the gain which were set up, in the AD translation part 10, the AD translation of this division video signal is carried out by them, and this value is stored in the AD translation value memory 12.

[0053]Drawing 4 (b) is a figure showing the division video signal which consists of a portion only below the DC levels of the analog VGA signal generated by the waveform processing section 7.

[0054]The automatic regulation part 13 acquires the maximum m of the output of the AD translation part 10 stored in the AD translation value memory 12, and compares with the quantization range median M of the AD translation part 10 (it is the median 127 when the AD translation part 10 quantizes at 8 bits). When larger than the range median M of the AD translation part 10, as for the automatic regulation part 13, the maximum m of the output of the AD translation part 10 lowers the preset value of the DC levels of the DC regenerating section 8 until the maximum m of the output of the AD translation part 10 turns into the range median M of the AD translation part 10. On the contrary, when smaller than the range median M of the AD translation part 10, as for the automatic regulation part 13, the maximum m of the output of the AD translation part 10 raises the preset value of the DC levels of the DC regenerating section 8 until the maximum m of the output of the AD translation part 10 turns into the range median M of the AD translation part 10. Drawing 4 (c) expresses the division video signal with which DC levels were adjusted.

[0055]After adjustment of these DC levels is completed, the automatic regulation part 13 acquires the minimum s of the output of the AD translation part 10 stored in the AD translation value memory 12. When the acquired minimum s is 0, the automatic regulation part 13 lowers one step of gain levels, after raising a gain level until the output minimum s of the AD translation part 10 becomes one or more. On the contrary, when the output minimum s of the AD translation part 10 is one or more, the automatic regulation part 13 lowers a gain level until the output minimum s of the AD translation part 10 is set to 0. Drawing 4 (d) expresses the division video signal with which the gain was adjusted.

[0056]And after these adjustments are completed, the automatic regulation part 13 stores in the adjustment value storing memory 14 the DC levels of the DC regenerating section 8 and the gain of the analog amplifier part 9 which were adjusted, and makes the waveform processing section 7 a non−operating state. In a non−operating state, the waveform processing section 7 does not perform operation which halves the analog VGA signal inputted with DC levels, but outputs the inputted analog VGA signal as it is (refer to drawing 4 (e)).

[0057]And in inputting an NTSC video signal from the actual image output unit 1. Operation setting of the automatic regulation part 13 is made into non−adjustment mode, the DC levels and the gain which were stored in the adjustment value storing memory 14 are set as the DC regenerating section 8 and the analog amplifier part 9, and it is made to perform DC−levels

conversion and amplification of an analog VGA signal.
[0058]Although the waveform processing section 7 halved the analog VGA signal inputted with DC levels and decided to generate the division video signal which consists of a portion only below the DC levels of an analog VGA signal in this embodiment, It is good also as generating the division video signal which consists of a portion only more than the DC levels of an analog VGA signal.
[0059]
[Effect of the Invention]According to the LED display device control device of this invention according to claim 1, as mentioned above. It is a LED display device control device which changes the analog video signal corresponding to each trichromatic color into the digital video signal for displaying an image by a LED display device, DC regenerating section which sets the DC levels of said analog video signal as a predetermined level, The analog amplifier part which amplifies the analog video signal with which DC levels were set up by said DC regenerating section by a predetermined gain, The analog video signal amplified in said analog amplifier part so that the central level of the analog video signal outputted from the AD translation part changed into a digital video signal and said DC regenerating section may become the median of the range of said AD translation part, So that it may become equal to the maximum range width of the analog video signal outputted from said analog amplifier part, and the range widths of said AD translation part while adjusting the DC levels of said DC regenerating section automatically, By providing the automatic regulation part which adjusts the gain of said analog amplifier part automatically, a LED display device control device without an alignment error [in / it is possible to perform adjustment of DC levels and a gain easily and correctly, and / these adjustments] can be provided.
[0060]According to the invention according to claim 2, in the LED display device control device according to claim 1 said automatic regulation part, Set up the DC levels of said DC regenerating section, and it ranks second so that the maximum level of said analog video signal may serve as the maximum of the range of said A/D converter, By repeating operation of setting up the gain of said analog amplifier part so that the minimum level of said analog video signal may serve as the minimum of the range of said A/D converter, Or set up the DC levels of said DC regenerating section, and it ranks second so that the minimum level of said analog video signal may serve as the minimum of the range of said A/D converter, By repeating operation of setting up the gain of said analog amplifier so that the maximum level of said analog video signal may serve as the maximum of the range of said A/D converter, By having decided to adjust automatically the DC levels of said DC regenerating section, and the gain of said analog amplifier part, a LED display device control device with an automatic regulation part able to adjust automatically the DC levels of DC regenerating section and the gain of said analog amplifier part can be provided.
[0061]In [according to the invention according to claim 3] the LED display device control device according to claim 1, Bisect the analog video signal inputted into said DC regenerating section, and it has a waveform processing section which generates the division video signal which consists of a portion only more than the DC levels of said analog video signal, or below DC levels, Said automatic regulation part so that the central level of the analog video signal which is the maximum or the minimum of said division video signal, and the median of the range of said AD translation part may be in agreement, So that it may become equal to the minimum of an analog video signal or the maximum level which is the minimum or the maximum of said division video signal outputted from said analog amplifier part, and the range widths of said AD translation part after adjusting the DC levels of said DC regenerating section automatically, By having decided to adjust the gain of said analog amplifier part automatically, a LED display device control device with an automatic regulation part able to adjust automatically the DC levels of DC regenerating section and the gain of said analog amplifier part can be provided.

[Translation done.]

TECHNICAL FIELD

[Field of the Invention]This invention relates to the LED display device control device which controls the level difference of the signal of R [of the picture image data inputted into an LED full color display], G, and B each color.

[Translation done.]

PRIOR ART

[Description of the Prior Art]In recent years, the LED display device using the light emitting diode (henceforth "LED") of red (R) green (G) blue (B) of full color correspondence is beginning to spread quickly. This LED display device is used as a display on which the video signal of the NTSC system which various image output units, such as a television tuner, a videocassette recorder, a laser disc (registered trademark) player, and a video camera, output is generally displayed. The NTSC video signal outputted from these image output units is changed into the digital video signal corresponding to each color of R, G, and B by the LED display device control device, and is inputted into a LED display device, and an image is displayed on a LED display device.
[0003]Drawing 5 is a block diagram of the conventional LED display device control device.
[0004]In drawing 5, the image output units 1 are image output units, such as a television tuner, a videocassette recorder, a laser disc player, and a video camera. The signal generator 2 generates and outputs the signal for adjustment for the DC levels of the LED display device control device 20, and a gain adjustment. The mixed branching filter 3 is constituted by the directional coupler. The scan converter 4 divides into the chrominance signal C and the luminance signal Y the video signal of the NTSC system inputted from the image output unit 1 or the signal generator 2 through the mixed branching filter 3, and performs the color adjustment of hue, brightness, and chroma saturation. The chrominance signal C is divided into color-difference-signal R-Y (U) and B-Y(V) after that. After analog-to-digital conversion (henceforth a "AD translation") of these signals is carried out, scaling of them is carried out to an effective display area, they are changed into digital one R and G and B signal, and analogue conversion is carried out to the last, and they are outputted as an analog VGA signal of R, G, and B.
[0005]The LED display device control device 20 changes into the digital video signal corresponding to each color of R, G, and B the analog VGA signal of R, G, and B inputted from the scan converter 4. LED display device 6 is the display in which LED of much R, G, and B each color was arranged.
The digital video signal corresponding to each color of R, G, and B which are inputted is displayed as full color video.

[0006]The LED display device control device 20 comprises the DC regenerative circuit 21, the analog amplifier circuit 22, AD conversion circuit 23, and the signal converter 24. The DC regenerative circuit 21 is a circuit which performs DC-levels adjustment of the analog VGA signal inputted from the scan converter 4.
Resistance can be changed according to the angle of rotation of the knob of the volume 21a for DC-levels adjustment, and the DC levels of the analog VGA signal outputted from the DC regenerative circuit 21 by this are made variable.
The analog amplifier circuit 22 is a circuit which performs gain level adjustment of the analog VGA signal with which adjustment of DC levels was performed in the DC regenerative circuit 21.
Resistance can be changed according to the angle of rotation of the knob of the volume 22a for gain adjustments, and the gain (amplification factor) of the analog VGA signal outputted from the analog amplifier circuit 22 by this can be made variable.

AD conversion circuit 23 quantizes the analog VGA signal with which DC-levels adjustment and a gain adjustment were carried out by the DC regenerative circuit 21 and the analog amplifier circuit 22, and changes it into a digital VGA signal. The signal converter 24 changes a digital VGA signal into the digital video signal corresponding to each color of R for LED display devices, G, and B.

[0007]In the conventional LED display device control device of the above composition, some errors arise with dispersion in the characteristic of the scan converter 4 actually in the DC levels and amplitude of each analog VGA signal of R, G, and B. Therefore, dispersion in average value produces the digital VGA signal outputted from an AD conversion circuit between R, G, and B signal by the error of the DC levels of each of this analog VGA signal. Dispersion produces the digital VGA signal outputted from an AD conversion circuit in amplitude value between R, G, and B signal by the error of the amplitude of each analog VGA signal.

[0008]Drawing 6 is a figure explaining the correcting method of the error of an analog VGA signal, drawing 6 (a) expresses an example of the analog VGA signal before amendment with error, drawing 6 (b) expresses the digital VGA signal before amendment with error, and drawing 6 (c) expresses the analog VGA signal after amendment with error.

[0009]In drawing 6, the rectangular wave signal of the repetition by maximum luminance and minimum luminance (black level) is inputted as a signal for adjustment from the signal generator 2 as an example. D_i+P_i in drawing 6 The maximum brightness value of an analog VGA signal, D_i-P_i is a minimum luminance value of an analog VGA signal, D_i is the median of an analog VGA signal, and, as for the range maximum of AD conversion circuit 23, and D-P, the range minimum of AD conversion circuit 23 and D of D+P are the range median of AD conversion circuit 23.

[0010]In the example of drawing 6 (a), since maximum brightness value D_i+P_i of the analog VGA signal is over range maximum D+P of AD conversion circuit 23, all the portions into which the digital VGA signal exceeded D+P like drawing 6 (b) serve as D+P. Since minimum luminance value D_i-P_i of an analog VGA signal is larger than range minimum D-P of AD conversion circuit 23, the range of the low of AD conversion circuit 23 is not used effectively. Since range-widths $2P_i$ of the luminance value of an analog VGA signal differs from the range widths 2P of AD conversion circuit 23, dispersion may produce the digital VGA signal outputted from an AD conversion circuit in amplitude value between R, G, and B signal.

[0011]Then, in order to amend the error of these each analog VGA signal, DC regenerative circuit is equipped with the volume 21a for DC-levels adjustment about each of each analog VGA signal of R, G, and B.
The analog amplifier circuit 22 is equipped with the volume 22a for gain level adjustment about each of each analog VGA signal of R, G, and B.

[0012]Amendment of the error of each analog VGA signal is performed in the following procedures.

[0013]First, generate the signal for adjustment with the signal generator 2, and this signal for adjustment is inputted into the scan converter 4, The analog VGA signal outputted from the scan converter 4 is inputted into the DC regenerative circuit 21 and the analog amplifier circuit 22, and the amplified analog VGA signal (signal in the point A of drawing 5) which is outputted from the analog amplifier circuit 22 to each signal of R, G, and B is measured with an oscilloscope. The signal (for example, a rectangle signal and a saw-tooth-wave signal) with which the luminosity of each color consists of a repetition by the portion used as the portion used as the maximum and the minimum (black level) is used for this signal for adjustment.

[0014]A tuning company observes the waveform of an oscilloscope and calculates the wave-like median Di from an input waveform. And observing the waveform of an oscilloscope, a tuning company turns the volume 21a for DC-levels adjustment, and adjusts resistance so that the median Di of an input waveform may be in agreement with the conversion midrange value D of an AD conversion circuit. The maximum and the minimum of an analog VGA signal which are outputted from the analog amplifier circuit 22 and which were amplified adjust the gain of the

analog amplifier circuit 22 so that it may become the maximum of the conversion range of AD conversion circuit 23, and the minimum. A tuning company performs this adjustment by turning the volume 22a for gain adjustments, observing the waveform of an oscilloscope.

[0015]Thus, maximum brightness value D_i+P_i of an analog VGA signal and minimum luminance value D_i-P_i which are outputted from the analog amplifier circuit 22 to each signal of R, G, and B and which were amplified, It is adjusted so that it may be in agreement with range maximum D+P and range minimum D−P of AD conversion circuit 23, and amendment of the error by dispersion in the characteristic of the scan converter 4 is performed.

[Translation done.]

EFFECT OF THE INVENTION

[Effect of the Invention]According to the LED display device control device of this invention according to claim 1, as mentioned above. It is a LED display device control device which changes the analog video signal corresponding to each trichromatic color into the digital video signal for displaying an image by a LED display device, DC regenerating section which sets the DC levels of said analog video signal as a predetermined level, The analog amplifier part which amplifies the analog video signal with which DC levels were set up by said DC regenerating section by a predetermined gain, The analog video signal amplified in said analog amplifier part so that the central level of the analog video signal outputted from the AD translation part changed into a digital video signal and said DC regenerating section may become the median of the range of said AD translation part, So that it may become equal to the maximum range width of the analog video signal outputted from said analog amplifier part, and the range widths of said AD translation part while adjusting the DC levels of said DC regenerating section automatically, By providing the automatic regulation part which adjusts the gain of said analog amplifier part automatically, a LED display device control device without an alignment error [in / it is possible to perform adjustment of DC levels and a gain easily and correctly, and / these adjustments] can be provided.
[0060]According to the invention according to claim 2, in the LED display device control device according to claim 1 said automatic regulation part, Set up the DC levels of said DC regenerating section, and it ranks second so that the maximum level of said analog video signal may serve as the maximum of the range of said A/D converter, By repeating operation of setting up the gain of said analog amplifier part so that the minimum level of said analog video signal may serve as the minimum of the range of said A/D converter, Or set up the DC levels of said DC regenerating section, and it ranks second so that the minimum level of said analog video signal may serve as the minimum of the range of said A/D converter, By repeating operation of setting up the gain of said analog amplifier so that the maximum level of said analog video signal may serve as the maximum of the range of said A/D converter, By having decided to adjust automatically the DC levels of said DC regenerating section, and the gain of said analog amplifier part, a LED display device control device with an automatic regulation part able to adjust automatically the DC levels of DC regenerating section and the gain of said analog amplifier part can be provided.
[0061]In [according to the invention according to claim 3] the LED display device control device according to claim 1, Bisect the analog video signal inputted into said DC regenerating section, and it has a waveform processing section which generates the division video signal which consists of a portion only more than the DC levels of said analog video signal, or below DC levels, Said automatic regulation part so that the central level of the analog video signal which is the maximum or the minimum of said division video signal, and the median of the range of said AD translation part may be in agreement, So that it may become equal to the minimum of an analog video signal or the maximum level which is the minimum or the maximum of said division video signal outputted from said analog amplifier part, and the range widths of said AD translation part after adjusting the DC levels of said DC regenerating section automatically, By having decided to adjust the gain of said analog amplifier part automatically, a LED display device

control device with an automatic regulation part able to adjust automatically the DC levels of DC regenerating section and the gain of said analog amplifier part can be provided.

[Translation done.]

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention]However, while the tuning company observed the waveform of the oscilloscope in the above-mentioned conventional LED display device control device, the volume 21a for DC-levels adjustment and the volume 22a for gain adjustments needed to be adjusted, and tuning was troublesome. In order that the tuning company might memorize the range D of the conversion range of AD conversion circuit 23, D+P, and D-P at the time of adjustment of each volume, there was a problem that tuning was troublesome and workability was also missing. Since the adjustment value was saved by the volume 21a for DC-levels adjustment, and the volume 22a for gain adjustments, there was also a problem that an adjustment value might change with vibration. The range of the conversion range of AD conversion circuit 23 was not fixed correctly with a device according to the manufacture error of AD conversion circuit 23, etc., but also had the problem that it could not adjust to dispersion in the range of the conversion range of AD conversion circuit 23 depending on the above-mentioned conventional adjustment procedure.
[0017]Then, the technical problem of this invention is in solving the above-mentioned conventional problem, and there is in providing a LED display device control device without an alignment error [in / it is possible to perform adjustment of DC levels and a gain easily and correctly and / these adjustments].

[Translation done.]

MEANS

[Means for Solving the Problem]In order to solve an aforementioned problem a LED display device control device of this invention, It is a LED display device control device which changes an analog video signal corresponding to each trichromatic color into a digital video signal for displaying an image by a LED display device, DC regenerating section which sets DC levels of said analog video signal as a predetermined level, An analog amplifier part which amplifies an analog video signal with which DC levels were set up by said DC regenerating section by a predetermined gain, An analog video signal amplified in said analog amplifier part so that a central level of an analog video signal outputted from an AD translation part changed into a digital video signal and said DC regenerating section may become the median of a range of said AD translation part, While adjusting DC levels of said DC regenerating section automatically, composition of providing an automatic regulation part which adjusts a gain of said analog amplifier part automatically is comprised so that it may become equal to maximum range width of an analog video signal outputted from said analog amplifier part, and range widths of said AD translation part.
[0019]By this composition, a LED display device control device without an alignment error [in / it is possible to perform adjustment of DC levels and a gain easily and correctly, and / these adjustments] can be provided.
[0020]
[Embodiment of the Invention]The LED display device control device of this invention according to claim 1, It is a LED display device control device which changes the analog video signal corresponding to each trichromatic color into the digital video signal for displaying an image by a LED display device, DC regenerating section which sets the DC levels of said analog video signal as a predetermined level, The analog amplifier part which amplifies the analog video signal with which DC levels were set up by said DC regenerating section by a predetermined gain, The analog video signal amplified in said analog amplifier part so that the central level of the analog video signal outputted from the AD translation part changed into a digital video signal and said DC regenerating section may become the median of the range of said AD translation part, So that it may become equal to the maximum range width of the analog video signal outputted from said analog amplifier part, and the range widths of said AD translation part while adjusting the DC levels of said DC regenerating section automatically, In order that it may have composition possessing the automatic regulation part which adjusts the gain of said analog amplifier part automatically and an automatic regulation part may adjust automatically the DC levels of DC regenerating section, and the gain of said analog amplifier part by this composition, It becomes unnecessary for a tuning company to perform adjustment of DC levels and a gain using an oscilloscope, and work becomes easy. In order not to use volume, DC levels and the preset value of a gain are not out of order by vibration of apparatus. Adjustment of DC levels and a gain is attained correctly not related at dispersion by the individual difference of the conversion range by the side of the analog of an AD translation part.
[0021]The invention according to claim 2 is the LED display device control device according to claim 1, and said automatic regulation part, Set up the DC levels of said DC regenerating section, and it ranks second so that the maximum level of said analog video signal may serve as the

maximum of the range of said A/D converter, By repeating operation of setting up the gain of said analog amplifier part so that the minimum level of said analog video signal may serve as the minimum of the range of said A/D converter, Or set up the DC levels of said DC regenerating section, and it ranks second so that the minimum level of said analog video signal may serve as the minimum of the range of said A/D converter, By repeating operation of setting up the gain of said analog amplifier so that the maximum level of said analog video signal may serve as the maximum of the range of said A/D converter, It supposes that the DC levels of said DC regenerating section and the gain of said analog amplifier part are adjusted automatically, and this composition enables an automatic regulation part to adjust automatically the DC levels of DC regenerating section, and the gain of said analog amplifier part.

[0022]The invention according to claim 3 is the LED display device control device according to claim 1, Bisect the analog video signal inputted into said DC regenerating section, and it has a waveform processing section which generates the division video signal which consists of a portion only more than the DC levels of said analog video signal, or below DC levels, Said automatic regulation part so that the central level of the analog video signal which is the maximum or the minimum of said division video signal, and the median of the range of said AD translation part may be in agreement, So that it may become equal to the minimum of an analog video signal or the maximum level which is the minimum or the maximum of said division video signal outputted from said analog amplifier part, and the range widths of said AD translation part after adjusting the DC levels of said DC regenerating section automatically, It supposes that the gain of said analog amplifier part is adjusted automatically, and this composition enables an automatic regulation part to adjust automatically the DC levels of DC regenerating section, and the gain of said analog amplifier part.

[0023]The 1 embodiment of this invention is described below, referring to drawings.

[0024](Embodiment 1) Drawing 1 is a block diagram of the LED display device control device concerning the embodiment of the invention 1.

[0025]In drawing 1, the image output units 1 are image output units, such as a television tuner, a videocassette recorder, a laser disc player, and a video camera. The signal generator 2 generates and outputs the signal for adjustment for the DC levels of the LED display device control device 5, and a gain adjustment. The mixed branching filter 3 is constituted by the directional coupler. The scan converter 4 divides into the chrominance signal C and the luminance signal Y the video signal of the NTSC system inputted from the image output unit 1 or the signal generator 2 through the mixed branching filter 3, and performs the color adjustment of hue, brightness, and chroma saturation. The chrominance signal C is divided into color-difference-signal R-Y (U) and B-Y(V) after that. After analog-to-digital conversion (henceforth a "AD translation") of these signals is carried out, scaling of them is carried out to an effective display area, they are changed into digital one R and G and B signal, and analogue conversion is carried out to the last, and they are outputted as an analog VGA signal of R, G, and B.

[0026]The LED display device control device 5 changes into the digital video signal corresponding to each color of R, G, and B the analog VGA signal (analog video signal) of R, G, and B inputted from the scan converter 4. LED display device 6 is the display in which LED of much R, G, and B each color was arranged, and displays the digital video signal corresponding to each color of R, G, and B which are inputted as full color video.

[0027]The LED display device control device 5 comprises the DC regenerating section 8, the analog amplifier part 9, the AD translation part 10, the signal converter 11, the AD translation value memory 12, the automatic regulation part 13, and the adjustment value storing memory 14. The DC regenerating section 8 performs DC-levels adjustment of the analog VGA signal inputted from the scan converter 4. By the DC regenerating section 8, the analog amplifier part 9 performs gain level adjustment of the analog VGA signal with which adjustment of DC levels was performed, and by AGC (variable gain amplifier). The gain (amplification factor) of the analog VGA signal outputted from the analog amplifier part 9 can be made variable. The AD translation part 10 quantizes the analog VGA signal with which a gain adjustment and DC-levels adjustment were carried out by the DC regenerating section 8 and the analog amplifier part 9, and changes it into a digital VGA signal (analog video signal). The signal converter 11 changes a digital VGA signal

into the digital video signal for a display corresponding to each color of R for LED display devices, G, and B.

[0028]The AD translation value memory 12 stores the value of the digital VGA signal outputted from the AD translation part 10. Based on the value of the digital VGA signal stored in the AD translation value memory 12, the automatic regulation part 13 the central level of the analog video signal outputted from the DC regenerating section 8 so that it may become the median of the range of the AD translation part 10, While adjusting the DC levels of the DC regenerating section 8 automatically, the gain of the analog amplifier part 9 is adjusted automatically so that it may become equal to the maximum range width of an analog video signal and the range widths of the AD translation part 10 which are outputted from the analog amplifier part 9. The adjustment value storing memory 14 is a memory which stores the DC levels of the DC regenerating section 8 and the gain of the analog amplifier part 9 which the automatic regulation part 13 set up, and nonvolatile memory, such as a flash memory, is used.

[0029]In the LED display device control device of this embodiment constituted as mentioned above, the operation is explained hereafter.

[0030]First, let operation setting of the automatic regulation part 13 be adjustment mode at the time of adjustment of the DC levels of the DC regenerating section 8, and the gain of the analog amplifier part 9. Next, the NTSC video signal of 100% of white is made to output from the signal generator 2. This NTSC video signal is changed into an analog VGA signal by the scan converter 4, and is inputted into the DC regenerating section 8 of the LED display device control device 5.

[0031]Drawing 2 is a figure explaining the correcting method of the error of the analog VGA signal in Embodiment 1, and drawing 2 (a) expresses an example of the analog VGA signal of 100% of white before error correction. D_i+P_i in drawing 2 The maximum brightness value of an analog VGA signal, D_i-P_i is a minimum luminance value of an analog VGA signal, D_i is the median of an analog VGA signal, and, as for the range maximum of the AD translation part 10, and D−P, the range minimum of the AD translation part 10 and D of D+P are the range median of the AD translation part 10.

[0032]As the analog VGA signal of 100% of white is shown in drawing 2 (a), a level serves as a signal of the constant value of D_i+P_i.

[0033]The automatic regulation part 13 sets the DC levels of the DC regenerating section 8, and the gain of the analog amplifier part 9 as a default value first. After DC-levels adjustment and signal amplification are carried out by the DC levels and the gain which were set up, in the AD translation part 10, the AD translation of the analog VGA signal is carried out by them, and this value is stored in the AD translation value memory 12.

[0034]When level D_i+P_i of the analog VGA signal inputted into the DC regenerating section 8 is larger than maximum D+P of the range of an A/D converter at this time, The value of the digital VGA signal outputted from the AD translation part 10 is the maximum M of the output of an A/D converter (for example, when the AD translation part 10 quantizes at 8 bits.). Become the maximum 255 and when level D_i+P_i of an analog VGA signal is smaller than maximum D+P of the range of an A/D converter, The value of the digital VGA signal outputted from the AD translation part 10 turns into a value which quantized level D_i+P_i by the quantization level of the AD translation part 10.

[0035]Next, the automatic regulation part 13 reads the data stored in the AD translation value memory 12. If the read value is less than the maximum M of the output of an AD translation, the automatic regulation part 13 is set up raise the DC levels of the DC regenerating section 8, and it will raise the DC levels of the DC regenerating section 8 until the value of the digital VGA signal eventually outputted from the AD translation part 10 turns into the maximum M of the output of an AD translation.

[0036]On the other hand, if the read value is the maximum M of the output of an AD translation, the automatic regulation part 13, It sets up lower the DC levels of the DC regenerating section 8, and the value of the digital VGA signal eventually outputted from the AD translation part 10 drops the DC levels of the DC regenerating section 8 to this side in which less than the

maximum M of the output of an AD translation becomes.

[0037]Drawing 2 (b) expresses the analog VGA signal of 100% of white after error correction. Maximum level D_i+P_i of after [the end of the above-mentioned adjustment] of an analog VGA signal corresponds with maximum D+P of the range of the AD translation part 10.

[0038]Next, the NTSC signal of a gradation pattern is made to output from the signal generator 2. This NTSC video signal is changed into an analog VGA signal by the scan converter 4, and is inputted into the DC regenerating section 8 of the LED display device control device 5. After DC-levels adjustment and signal amplification are carried out by the DC levels and the gain which were set up, in the AD translation part 10, the AD translation of the analog VGA signal is carried out by them, and this value is stored in the AD translation value memory 12.

[0039]The digital VGA signal after drawing 2 (c) carried out an example of the analog VGA signal of the gradation pattern before a gain adjustment and drawing 2 (d) carries out the AD translation of the analog VGA signal of drawing 2 (c) is expressed. As shown in a figure, when the gain of the analog amplifier part 9 has not been adjusted, when minimum D_i-P_i of an analog VGA signal is smaller than minimum D-P of the range of the AD translation part 10, When distortion arises to a digital VGA signal and minimum D_i-P_i of an analog VGA signal and minimum D-P of the range of the AD translation part 10 are not in agreement, imbalance arises in the luminosity of each color of R, G, and B, and reappearance of an exact color cannot be performed.

[0040]Next, the automatic regulation part 13 reads the data stored in the AD translation value memory 12. If the minimum of the read value is a larger value than 0, the automatic regulation part 13 is set up raise the gain of the analog amplifier part 9, and it will raise the gain of the analog amplifier part 9 until the minimum of the digital VGA signal eventually outputted from the AD translation part 10 is set to 0.

[0041]On the other hand, if the minimum of the read value is 0, the automatic regulation part 13 will be set up lower the gain of the analog amplifier part 9, and will drop the gain of the analog amplifier part 9 to this side where the value of the digital VGA signal eventually outputted from the AD translation part 10 becomes one or more.

[0042]Adjustment is ended by repeating adjustment of the DC levels of the above DC regenerating sections 8, and an automatic regulation of the gain of the analog amplifier part 9 several times. Drawing 2 (e) is a figure showing the analog VGA signal after that of adjustment of the DC levels of the DC regenerating section 8 and the gain of the analog amplifier part 9 is completed, Maximum D_i+P_i of an analog VGA signal and minimum D_i-P_i of after [adjustment] of an analog VGA signal correspond with maximum D+P of the range of the AD translation part 10, and minimum D-P, respectively.

[0043]After the above-mentioned adjustment is completed, the automatic regulation part 13 stores in the adjustment value storing memory 14 the DC levels of the DC regenerating section 8 and the gain of the analog amplifier part 9 which were adjusted. And in inputting an NTSC video signal from the actual image output unit 1. Operation setting of the automatic regulation part 13 is made into non-adjustment mode, the DC levels and the gain which were stored in the adjustment value storing memory 14 are set as the DC regenerating section 8 and the analog amplifier part 9, and it is made to perform DC-levels conversion and amplification of an analog VGA signal.

[0044]As mentioned above, according to the LED display device control device of this embodiment, dispersion can be controlled by adjusting the analog VGA signal of R, G, and B with dispersion with the characteristic of the scan converter 4 automatically. Since the digital VGA signal with which dispersion in the level of R, G, and B was controlled is inputted into the signal converter 11, it is changed into the digital video signal for LED display devices and picture image data is displayed on LED display device 6, it becomes possible to perform a quality display. In order that it is not necessary to use an oscilloscope for adjustment of the DC levels of the DC regenerating section 8, and adjustment of the gain of the analog amplifier part 9 and the automatic regulation part 13 may carry out, these adjustments are simplified dramatically and it becomes possible to perform these adjustments for a short time. The DC levels and the gain

which were adjusted are stored in the adjustment value storing memory 14 which is nonvolatile memory, In order that these values stored in the adjustment value storing memory 14 may be read also at the time of power supply starting and it may set them as the DC regenerating section 8 and the analog amplifier part 9 next time, Like the conventional volume, a value does not change by vibration of apparatus and it becomes possible to perform display control of the LED display device which is always stabilized and does not have a gap in a color tone. Regardless of the individual difference (dispersion) of the conversion range of an AD translation part, exact adjustment of DC levels and a gain is attained.
[0045]Although it had composition which the automatic regulation part 13 adjusts DC levels using the analog VGA signal of 100% of white first, and uses the analog VGA signal of a gradation pattern next, and adjusts a gain in this embodiment, The automatic regulation part 13 is good also as composition which adjusts a gain using the analog VGA signal of 100% of white first, uses the analog VGA signal of a gradation pattern next, and adjusts DC levels. Even if it has such composition, adjustment of DC levels and a gain level can be automatically performed like an above-mentioned case.
[0046](Embodiment 2) Drawing 3 is a block diagram of the LED display device control device concerning the embodiment of the invention 2.
[0047]In drawing 3, 1 an image output unit and 2 a signal generator and 3 A mixed branching filter, 4 a scan converter and 5 a LED display device control device and 6 A LED display device, Since an automatic regulation part and 14 are [an analog amplifier part and 10] adjustment value storing memories an AD translation value memory and 13 an AD translation part and 11 DC regenerating section and 9 as for a signal converter and 12 and 8 of these is the same as that of drawing 1, a same sign is attached and explanation is omitted.
[0048]In this embodiment, the waveform processing section 7 halves the analog VGA signal inputted with DC levels, and generates the division video signal which consists of a portion only below the DC levels of an analog VGA signal.
[0049]In the LED display device control device of this embodiment constituted as mentioned above, the operation is explained hereafter.
[0050]First, let operation setting of the automatic regulation part 13 be adjustment mode at the time of adjustment of the DC levels of the DC regenerating section 8, and the gain of the analog amplifier part 9. First, the automatic regulation part 13 sets the DC levels of the DC regenerating section 8, and the gain of the analog amplifier part 9 as a default value, and makes the waveform processing section 7 an operating state. Next, the NTSC video signal of monochrome fringe patterns is made to output from the signal generator 2. This NTSC video signal is changed into an analog VGA signal by the scan converter 4, and is inputted into the DC regenerating section 8 of the LED display device control device 5.
[0051]Drawing 4 is a figure explaining the correcting method of the error of the analog VGA signal in Embodiment 2, and drawing 4 (a) expresses an example of the analog VGA signal of monochrome fringe patterns before error correction. D_i+P_i in drawing 4 The maximum brightness value of an analog VGA signal, D_i-P_i is a minimum luminance value of an analog VGA signal, D_i is the median of an analog VGA signal, and, as for the range maximum of the AD translation part 10, and D−P, the range minimum of the AD translation part 10 and D of D+P are the range median of the AD translation part 10.
[0052]As shown in drawing 4 (a), as for the analog VGA signal of monochrome fringe patterns, a level serves as a rectangular wave signal with which D_i+P_i and a level consist of a repetition of 2 level with D_i-P_i. In an operating state, the waveform processing section 7 halves this analog VGA signal inputted with DC levels, and generates the division video signal which consists of a portion only below the DC levels of an analog VGA signal. After DC-levels adjustment and signal amplification are carried out by the DC levels and the gain which were set up, in the AD translation part 10, the AD translation of this division video signal is carried out by them, and this value is stored in the AD translation value memory 12.
[0053]Drawing 4 (b) is a figure showing the division video signal which consists of a portion only

below the DC levels of the analog VGA signal generated by the waveform processing section 7.
[0054]The automatic regulation part 13 acquires the maximum m of the output of the AD translation part 10 stored in the AD translation value memory 12, and compares with the quantization range median M of the AD translation part 10 (it is the median 127 when the AD translation part 10 quantizes at 8 bits). When larger than the range median M of the AD translation part 10, as for the automatic regulation part 13, the maximum m of the output of the AD translation part 10 lowers the preset value of the DC levels of the DC regenerating section 8 until the maximum m of the output of the AD translation part 10 turns into the range median M of the AD translation part 10. On the contrary, when smaller than the range median M of the AD translation part 10, as for the automatic regulation part 13, the maximum m of the output of the AD translation part 10 raises the preset value of the DC levels of the DC regenerating section 8 until the maximum m of the output of the AD translation part 10 turns into the range median M of the AD translation part 10. Drawing 4 (c) expresses the division video signal with which DC levels were adjusted.
[0055]After adjustment of these DC levels is completed, the automatic regulation part 13 acquires the minimum s of the output of the AD translation part 10 stored in the AD translation value memory 12. When the acquired minimum s is 0, the automatic regulation part 13 lowers one step of gain levels, after raising a gain level until the output minimum s of the AD translation part 10 becomes one or more. On the contrary, when the output minimum s of the AD translation part 10 is one or more, the automatic regulation part 13 lowers a gain level until the output minimum s of the AD translation part 10 is set to 0. Drawing 4 (d) expresses the division video signal with which the gain was adjusted.
[0056]And after these adjustments are completed, the automatic regulation part 13 stores in the adjustment value storing memory 14 the DC levels of the DC regenerating section 8 and the gain of the analog amplifier part 9 which were adjusted, and makes the waveform processing section 7 a non-operating state. In a non-operating state, the waveform processing section 7 does not perform operation which halves the analog VGA signal inputted with DC levels, but outputs the inputted analog VGA signal as it is (refer to drawing 4 (e)).
[0057]And in inputting an NTSC video signal from the actual image output unit 1. Operation setting of the automatic regulation part 13 is made into non-adjustment mode, the DC levels and the gain which were stored in the adjustment value storing memory 14 are set as the DC regenerating section 8 and the analog amplifier part 9, and it is made to perform DC-levels conversion and amplification of an analog VGA signal.
[0058]Although the waveform processing section 7 halved the analog VGA signal inputted with DC levels and decided to generate the division video signal which consists of a portion only below the DC levels of an analog VGA signal in this embodiment, It is good also as generating the division video signal which consists of a portion only more than the DC levels of an analog VGA signal.

[Translation done.]

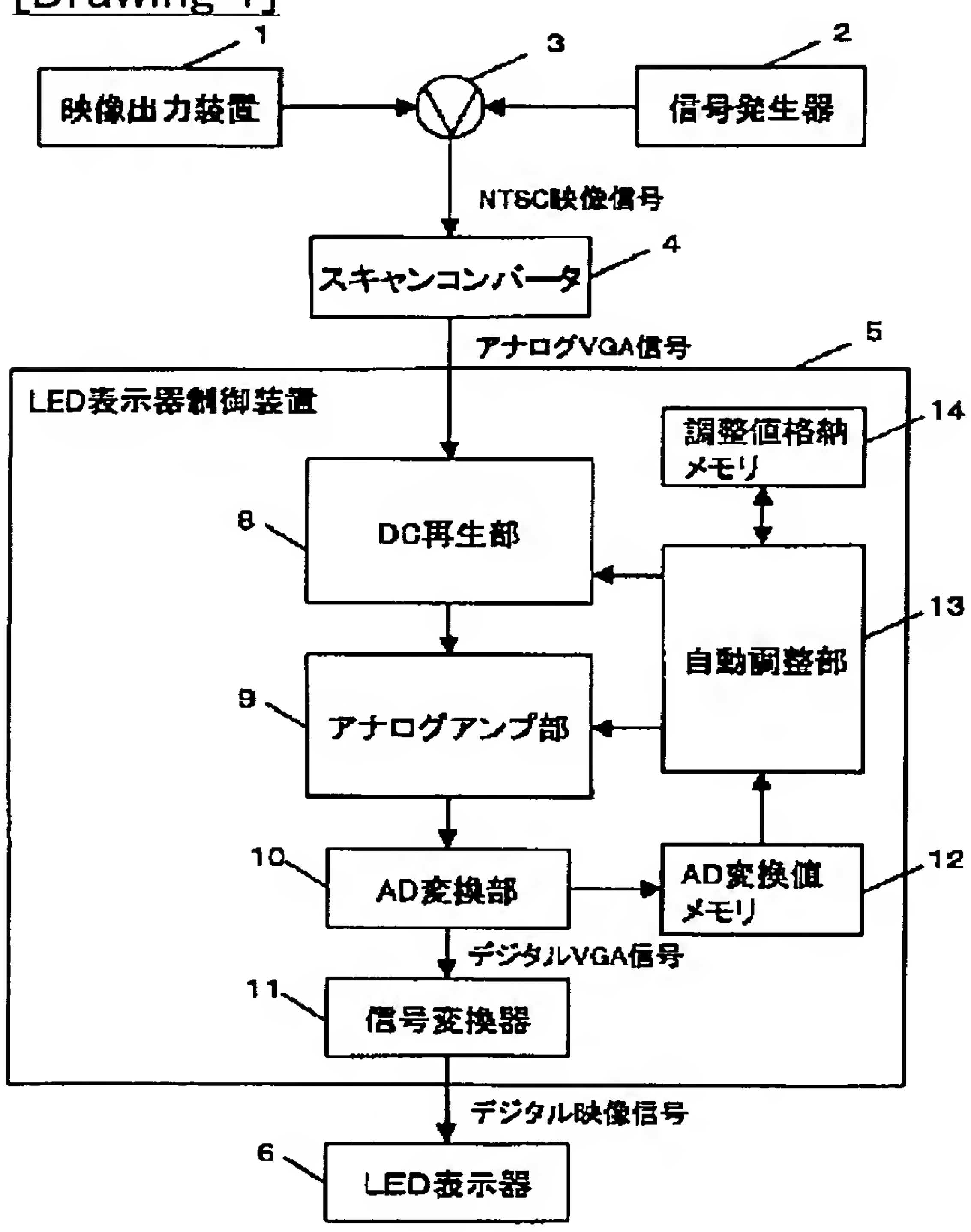
DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1]The block diagram of the LED display device control device concerning the embodiment of the invention 1
[Drawing 2]The figure explaining the correcting method of the error of the analog VGA signal in Embodiment 1
[Drawing 3]The block diagram of the LED display device control device concerning the embodiment of the invention 2
[Drawing 4]The figure explaining the correcting method of the error of the analog VGA signal in Embodiment 2
[Drawing 5]The block diagram of the conventional LED display device control device
[Drawing 6]The figure explaining the correcting method of the error of an analog VGA signal
[Description of Notations]
1 Image output unit
2 Signal generator
3 A mixed branching filter
4 Scan converter
5 LED display device control device
6 LED display device
7 Waveform processing section
8 DC regenerating section
9 Analog amplifier part
10 AD translation part
11 Signal converter
12 AD translation value memory
13 Automatic regulation part
14 Adjustment value storing memory
20 LED display device control device
21 DC regenerative circuit
21a Volume for DC-levels adjustment
22 Analog amplifier circuit
22a Volume for gain adjustments
23 AD conversion circuit
24 Signal converter

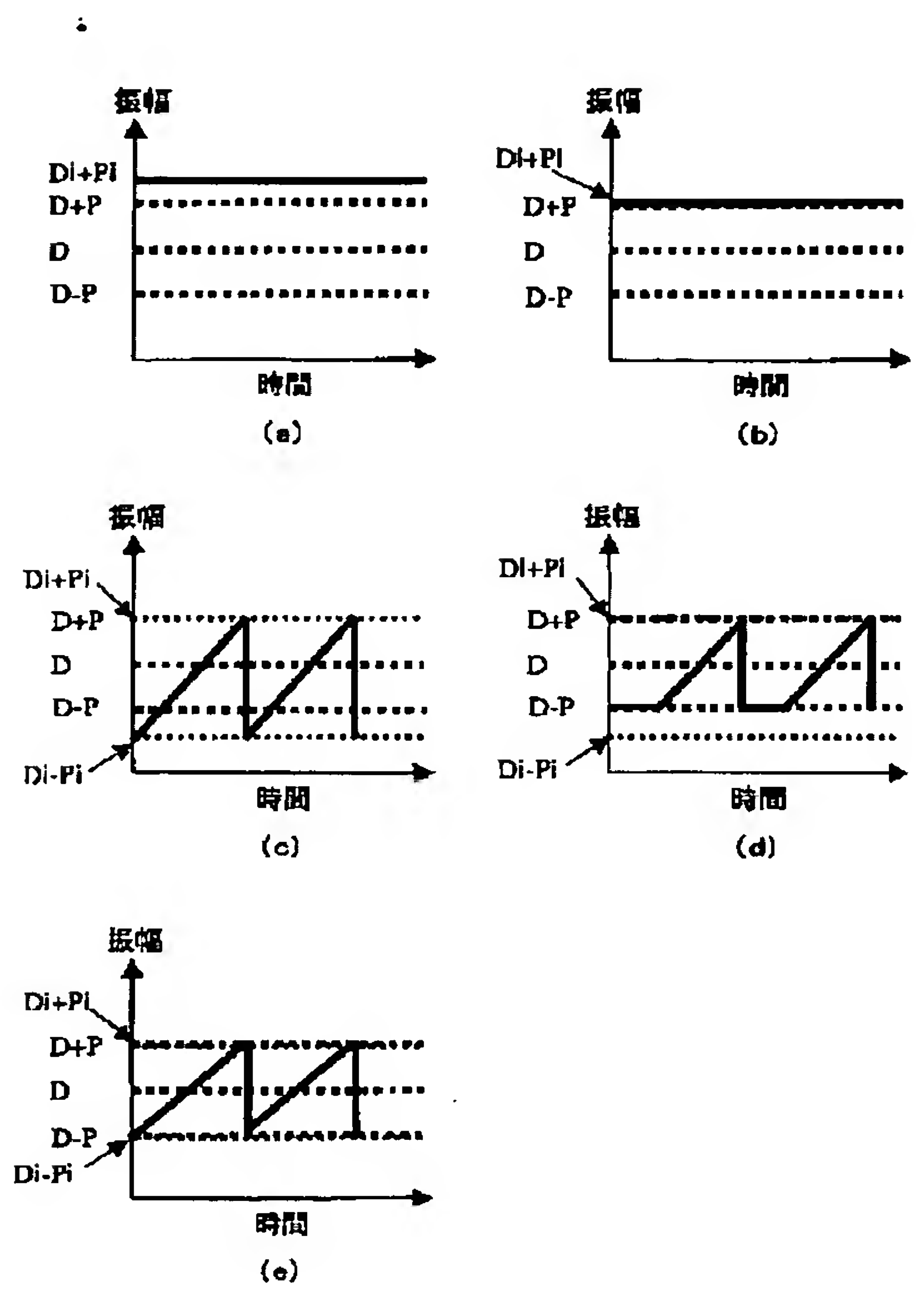
[Translation done.]

DRAWINGS

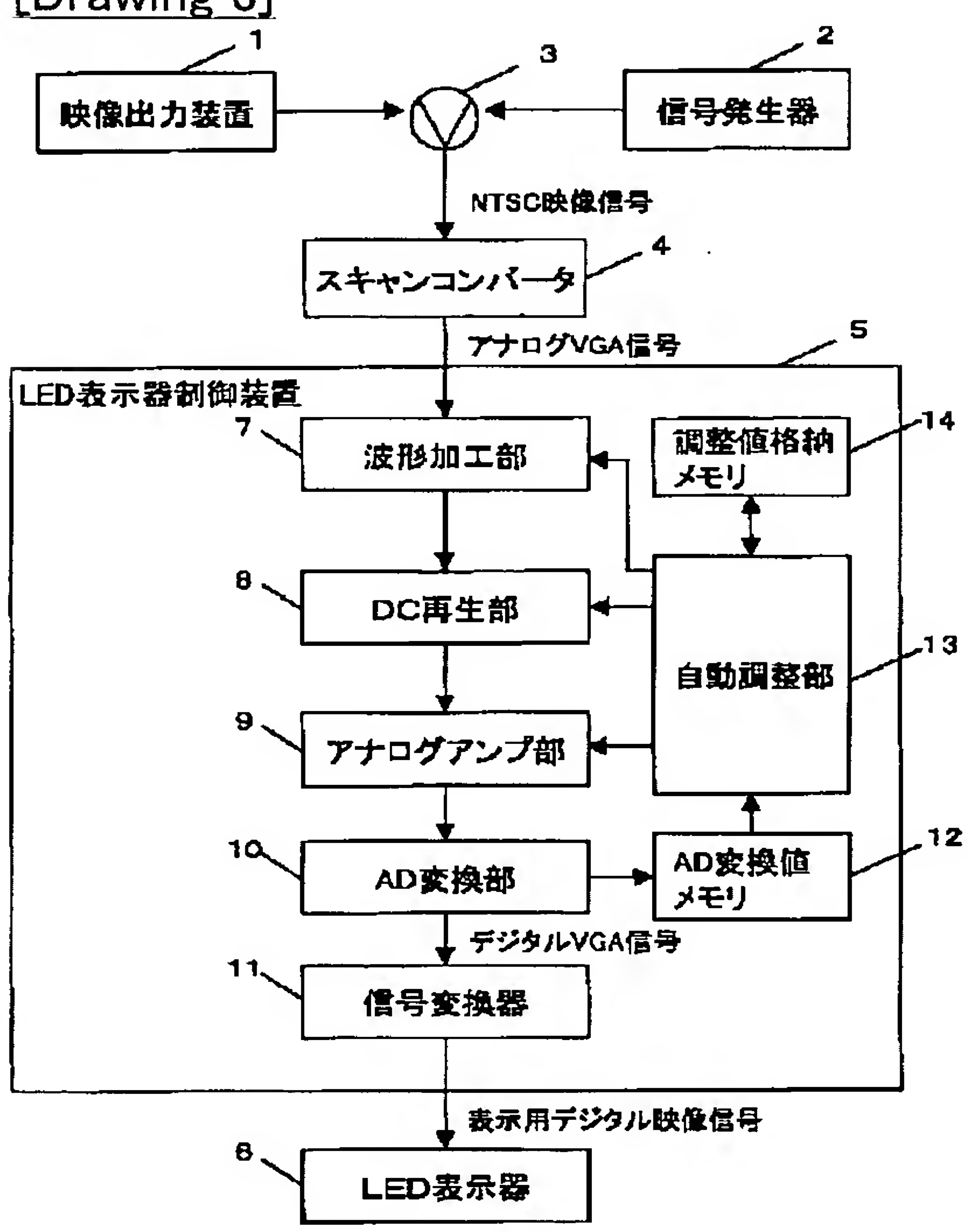
[Drawing 1]



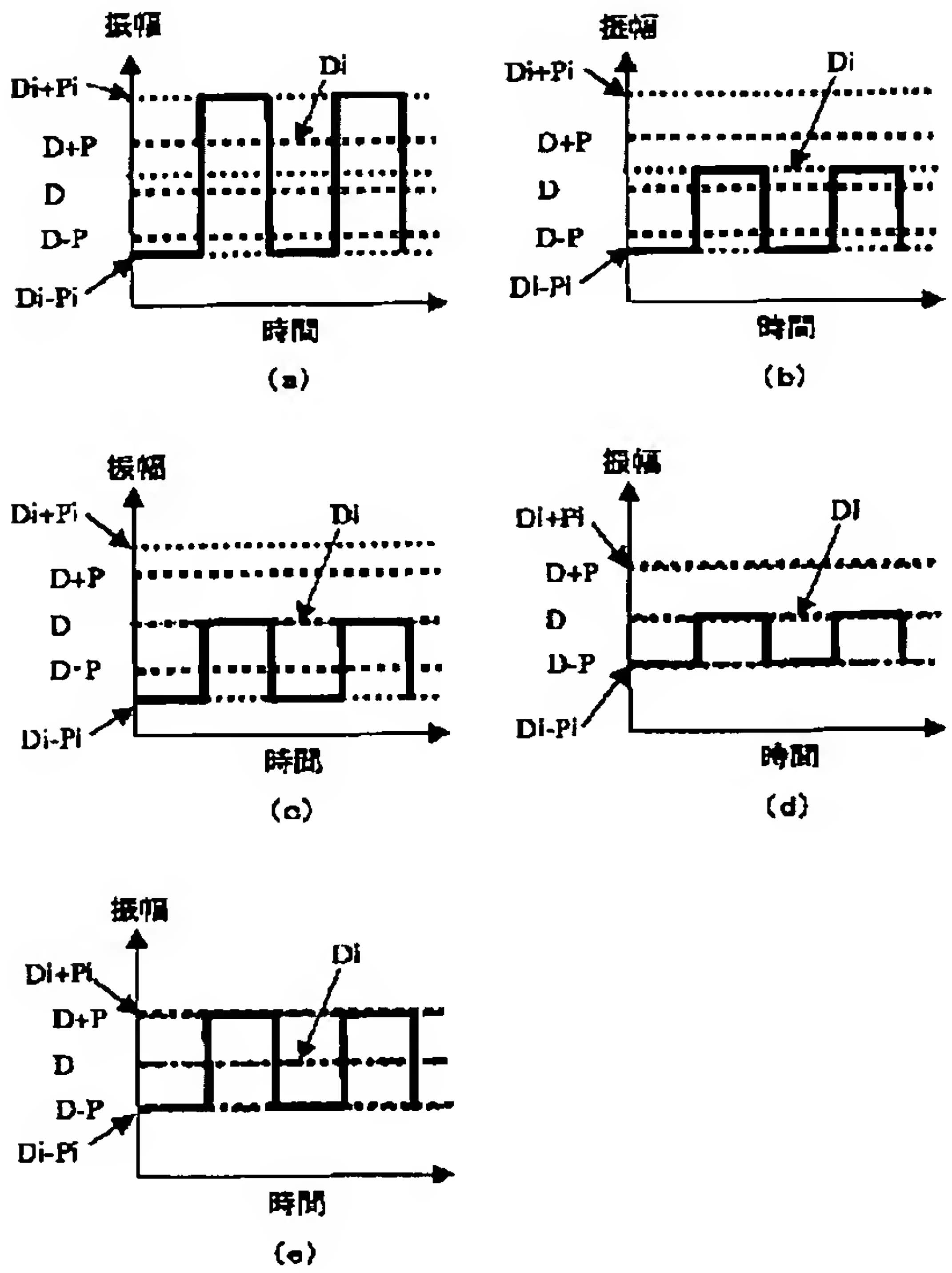
[Drawing 2]



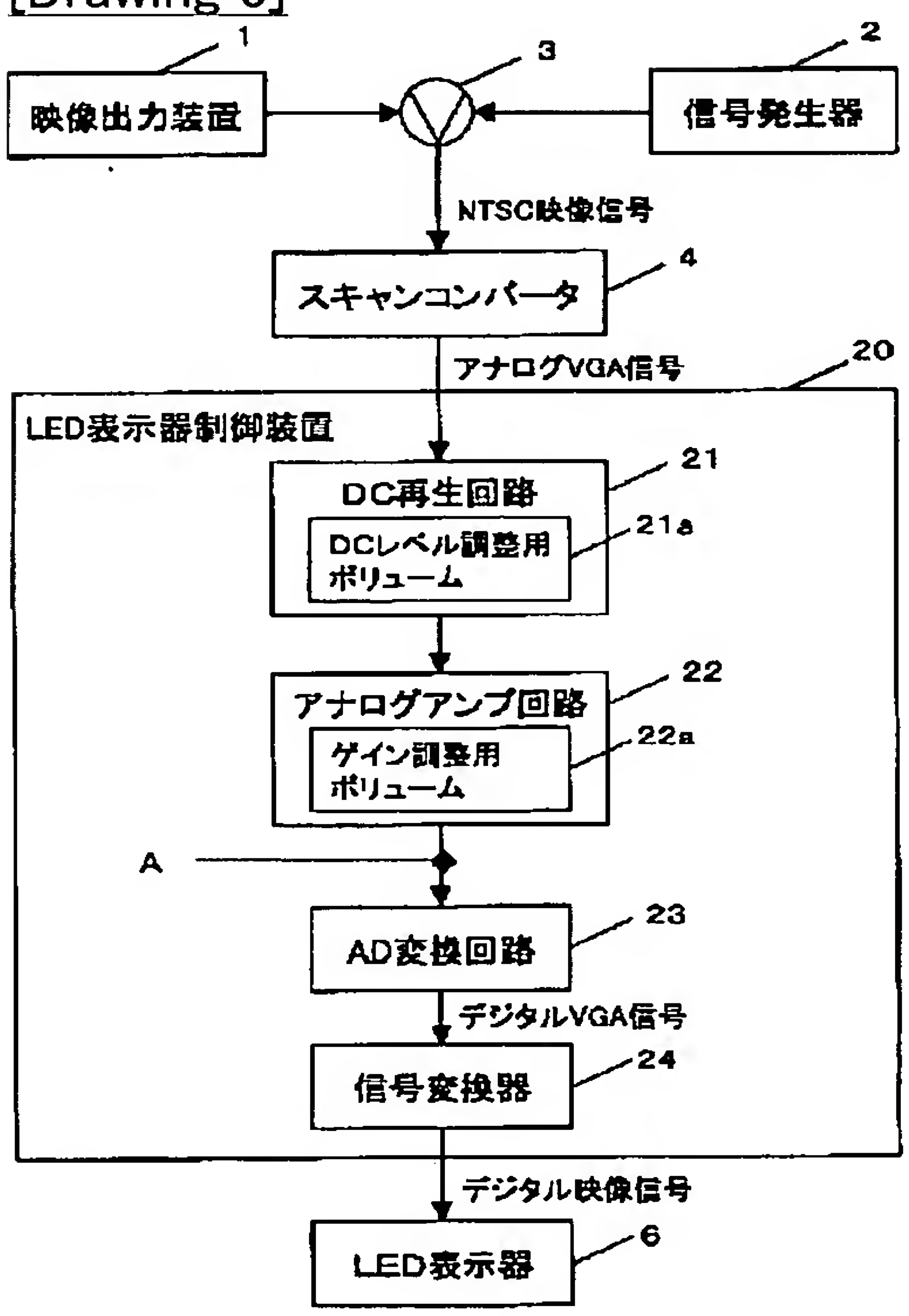
[Drawing 3]



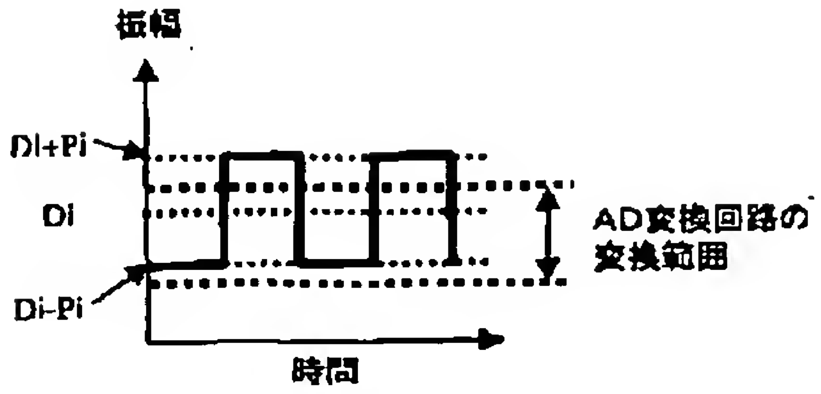
[Drawing 4]



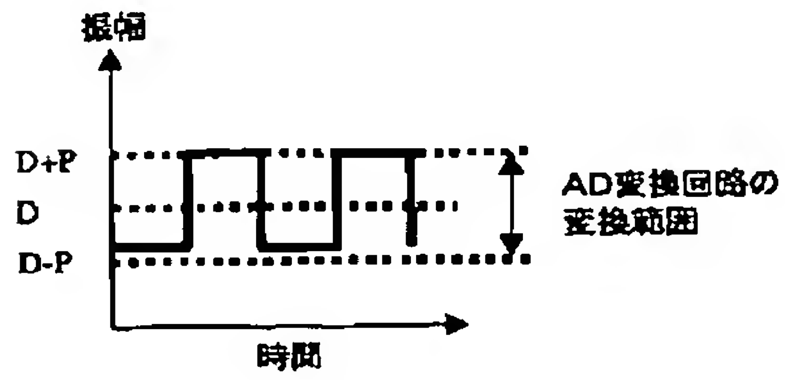
[Drawing 5]



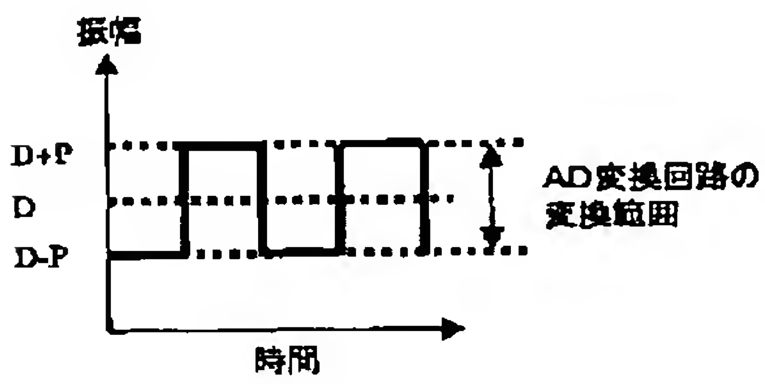
[Drawing 6]



(a)



(b)



(c)

[Translation done.]

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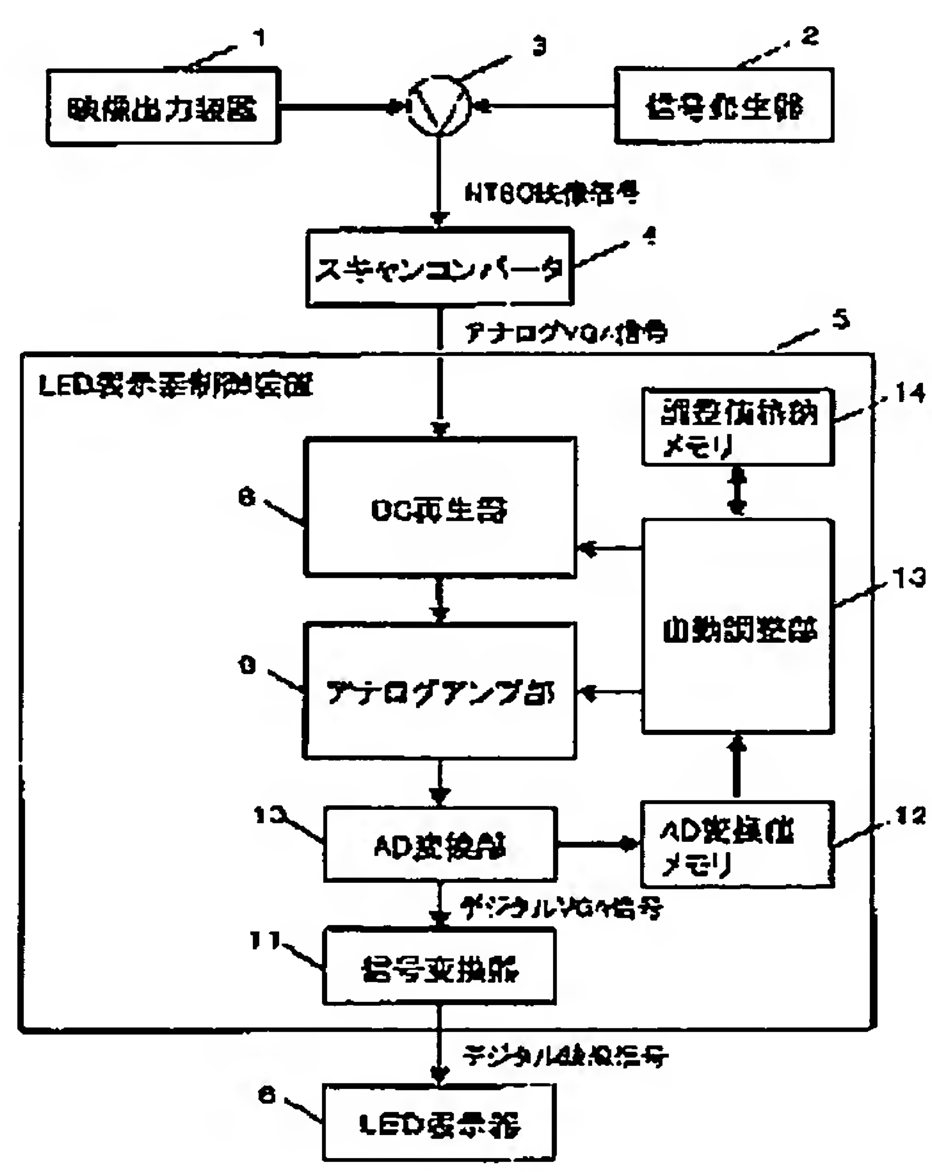
(54)【発明の名称】　ＬＥＤ表示器制御装置

(57)【要約】
【課題】　ＤＣレベル及びゲインの調整を容易かつ正確に行うことが可能であり、これらの調整における調整誤差のないＬＥＤ表示器制御装置を提供する。
【解決手段】　ＬＥＤ表示器制御装置５において、アナログ映像信号のＤＣレベルを所定のレベルに設定するＤＣ再生部８と、ＤＣ再生部８でＤＣレベルが設定されたアナログ映像信号を所定のゲインで増幅するアナログアンプ部９と、アナログアンプ部９で増幅されたアナログ映像信号を、デジタル映像信号に変換するＡＤ変換部１０と、ＤＣ再生部８から出力されるアナログ映像信号の中央レベルがＡＤ変換部１０のレンジの中央値になるように、ＤＣ再生部８のＤＣレベルを自動調整するとともに、アナログアンプ部９から出力されるアナログ映像信号の最大レンジ幅とＡＤ変換部１０のレンジ幅と等しくなるように、アナログアンプ部９のゲインを自動調整する自動調整部１３とを具備する。



【特許請求の範囲】

【請求項１】　３原色の各色に対応したアナログ映像信号を、ＬＥＤ表示器で映像を表示させるためのデジタル映像信号に変換するＬＥＤ表示器制御装置であって、
前記アナログ映像信号のＤＣレベルを所定のレベルに設定するＤＣ再生部と、
前記ＤＣ再生部でＤＣレベルが設定されたアナログ映像信号を所定のゲインで増幅するアナログアンプ部と、
前記アナログアンプ部で増幅されたアナログ映像信号を、デジタル映像信号に変換するＡＤ変換部と、
前記ＤＣ再生部から出力されるアナログ映像信号の中央レベルが前記ＡＤ変換部のレンジの中央値になるように、前記ＤＣ再生部のＤＣレベルを自動調整するとともに、前記アナログアンプ部から出力されるアナログ映像信号の最大レンジ幅と前記ＡＤ変換部のレンジ幅と等しくなるように、前記アナログアンプ部のゲインを自動調整する自動調整部と、を具備することを特徴とするＬＥＤ表示器制御装置。

【請求項２】　前記自動調整部は、
前記アナログ映像信号の最大レベルが前記ＡＤ変換器のレンジの最大値となるように前記ＤＣ再生部のＤＣレベルを設定し、次いで、前記アナログ映像信号の最小レベルが前記ＡＤ変換器のレンジの最小値となるように前記アナログアンプ部のゲインを設定する操作を反復することにより、
又は、前記アナログ映像信号の最小レベルが前記ＡＤ変換器のレンジの最小値となるように前記ＤＣ再生部のＤＣレベルを設定し、次いで、前記アナログ映像信号の最大レベルが前記ＡＤ変換器のレンジの最大値となるように前記アナログアンプのゲインを設定する操作を反復することにより、
前記ＤＣ再生部のＤＣレベル及び前記アナログアンプ部のゲインを自動調整することを特徴とする請求項１記載のＬＥＤ表示器制御装置。

【請求項３】　前記ＤＣ再生部に入力されるアナログ映像信号を二分し、前記アナログ映像信号のＤＣレベル以上のみ又はＤＣレベル以下のみの部分からなる分割映像信号を生成する波形加工部を備え、
前記自動調整部は、
前記分割映像信号の最大値又は最小値であるアナログ映像信号の中央レベルと前記ＡＤ変換部のレンジの中央値とが一致するように、前記ＤＣ再生部のＤＣレベルを自動調整した後、
前記アナログアンプ部から出力される前記分割映像信号の最小値又は最大値であるアナログ映像信号の最小又は最大レベルと前記ＡＤ変換部のレンジ幅と等しくなるように、前記アナログアンプ部のゲインを自動調整することを特徴とする請求項１記載のＬＥＤ表示器制御装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、ＬＥＤフルカラーディスプレイに入力される映像データのＲ，Ｇ，Ｂ各色の信号のレベル差を制御するＬＥＤ表示器制御装置に関する。

【０００２】

【従来の技術】近年、赤（Ｒ）、緑（Ｇ）、青（Ｂ）の発光ダイオード（以下、「ＬＥＤ」という。）を利用したフルカラー対応のＬＥＤ表示器が急速に普及し始めている。かかるＬＥＤ表示器は、一般に、テレビチューナ、ビデオデッキ、レーザーディスク（登録商標）プレーヤ、ビデオカメラ等の種々の映像出力装置が出力するＮＴＳＣ方式の映像信号を表示させる表示装置として使用される。これらの映像出力装置から出力されるＮＴＳＣ映像信号は、ＬＥＤ表示器制御装置によりＲ、Ｇ，Ｂの各色に対応するデジタル映像信号に変換され、ＬＥＤ表示器に入力され、ＬＥＤ表示器に映像が表示される。

【０００３】図５は従来のＬＥＤ表示器制御装置のブロック図である。

【０００４】図５において、映像出力装置１は、テレビチューナ、ビデオデッキ、レーザーディスクプレーヤ、ビデオカメラ等の映像出力装置である。信号発生器２は、ＬＥＤ表示器制御装置２０のＤＣレベル及びゲイン調整のための調整用信号を生成し出力する。混合分波器３は、方向性結合器により構成される。スキャンコンバータ４は、混合分波器３を通して映像出力装置１又は信号発生器２より入力されるＮＴＳＣ方式の映像信号を色信号Ｃと輝度信号Ｙとに分離し、色相、明度、彩度の色調整を行う。色信号Ｃはその後、色差信号Ｒ－Ｙ（Ｕ）、Ｂ－Ｙ（Ｖ）に分離される。これらの信号は、アナログ・デジタル変換（以下「ＡＤ変換」という。）された後に有効表示領域にスケーリングされ、デジタルＲ、Ｇ，Ｂ信号に変換されて最後にアナログ変換してＲ、Ｇ，ＢのアナログＶＧＡ信号として出力される。

【０００５】ＬＥＤ表示器制御装置２０は、スキャンコンバータ４から入力されるＲ，Ｇ，ＢのアナログＶＧＡ信号を、Ｒ，Ｇ，Ｂの各色に対応するデジタル映像信号に変換する。ＬＥＤ表示器６は、多数のＲ，Ｇ，Ｂ各色のＬＥＤが配列された表示装置であり、入力されるＲ，Ｇ，Ｂの各色に対応するデジタル映像信号をフルカラー映像として表示する。

【０００６】ＬＥＤ表示器制御装置２０は、ＤＣ再生回路２１、アナログアンプ回路２２、ＡＤ変換回路２３、及び信号変換器２４から構成されている。ＤＣ再生回路２１は、スキャンコンバータ４から入力されるアナログＶＧＡ信号のＤＣレベル調整を行う回路であり、ＤＣレベル調整用ボリューム２１ａのつまみの回転角によって抵抗値を変化させることができ、これによりＤＣ再生回路２１から出力されるアナログＶＧＡ信号のＤＣレベルを可変とする。アナログアンプ回路２２は、ＤＣ再生回路２１でＤＣレベルの調整が行われたアナログＶＧＡ信

JP,2003-271103,A STANDARD ZOOM-UP ROTATION No Rotation REVERSAL RELOAD

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号のゲインレベル調整を行う回路であり、ゲイン調整用ボリューム２２ａのつまみの回転角によって抵抗値を変化させることができ、これによりアナログアンプ回路２２から出力されるアナログＶＧＡ信号のゲイン（増幅率）を可変とすることができる。ＡＤ変換回路２３は、ＤＣ再生回路２１及びアナログアンプ回路２２によりＤＣレベル調整及びゲイン調整がされたアナログＶＧＡ信号を量子化しデジタルＶＧＡ信号に変換する。信号変換器２４は、デジタルＶＧＡ信号をＬＥＤ表示器用のＲ，Ｇ，Ｂの各色に対応するデジタル映像信号に変換する。

【０００７】以上のような構成の従来のＬＥＤ表示器制御装置において、実際にはスキャンコンバータ４の特性のばらつきにより、Ｒ，Ｇ，Ｂの各アナログＶＧＡ信号のＤＣレベル及び振幅に多少の誤差が生じる。従って、かかる各アナログＶＧＡ信号のＤＣレベルの誤差により、ＡＤ変換回路から出力されるデジタルＶＧＡ信号は、Ｒ，Ｇ，Ｂ信号間で平均値のばらつきが生じる。また、各アナログＶＧＡ信号の振幅の誤差により、ＡＤ変換回路から出力されるデジタルＶＧＡ信号は、Ｒ，Ｇ，Ｂ信号間で振幅値にばらつきが生じる。

【０００８】図６はアナログＶＧＡ信号の誤差の補正方法を説明する図であり、図６（ａ）は誤差の補正前のアナログＶＧＡ信号の一例、図６（ｂ）は誤差の補正前のデジタルＶＧＡ信号、図６（ｃ）は誤差の補正後のアナログＶＧＡ信号を表す。

【０００９】図６においては、一例として、信号発生器２から調整用信号として、最大輝度と最小輝度（黒レベル）との繰り返しの矩形波信号を入力している。尚、図６において、D_1+P_1はアナログＶＧＡ信号の最大輝度値、D_1-P_1はアナログＶＧＡ信号の最小輝度値、D_1はアナログＶＧＡ信号の中央値であり、Ｄ＋ＰはＡＤ変換回路２３のレンジ最大値、Ｄ－ＰはＡＤ変換回路２３のレンジ最小値、ＤはＡＤ変換回路２３のレンジ中央値である。

【００１０】図６（ａ）の例では、アナログＶＧＡ信号の最大輝度値D_1+P_1は、ＡＤ変換回路２３のレンジ最大値Ｄ＋Ｐを超えているため、デジタルＶＧＡ信号は、図６（ｂ）のように、Ｄ＋Ｐを超えた部分はすべてＤ＋Ｐとなる。また、アナログＶＧＡ信号の最小輝度値D_1-P_1は、ＡＤ変換回路２３のレンジ最小値Ｄ－Ｐよりも大きいため、ＡＤ変換回路２３の低レベルのレンジは有効に使用されない。また、アナログＶＧＡ信号の輝度値のレンジ幅$2P_1$がＡＤ変換回路２３のレンジ幅２Ｐと異なるため、ＡＤ変換回路から出力されるデジタルＶＧＡ信号は、Ｒ，Ｇ，Ｂ信号間で振幅値にばらつきが生じうる。

【００１１】そこで、これら各アナログＶＧＡ信号の誤差を補正するため、ＤＣ再生回路には、Ｒ，Ｇ，Ｂの各アナログＶＧＡ信号のそれぞれについて、ＤＣレベル調整用ボリューム２１ａが備えられており、アナログアンプ回路２２には、Ｒ，Ｇ，Ｂの各アナログＶＧＡ信号のそれぞれについて、ゲインレベル調整用ボリューム２２ａが備えられている。

【００１２】各アナログＶＧＡ信号の誤差の補正は、以下のような手順で行われる。

【００１３】まず、信号発生器２で調整用信号を発生させ、この調整用信号をスキャンコンバータ４に入力し、スキャンコンバータ４から出力されるアナログＶＧＡ信号をＤＣ再生回路２１，アナログアンプ回路２２に入力し、Ｒ，Ｇ，Ｂの各信号に対してアナログアンプ回路２２から出力される増幅されたアナログＶＧＡ信号（図５の点Ａにおける信号）をオシロスコープで測定する。この調整用信号には、各色の輝度が最大となる部分と最小（黒レベル）となる部分との繰り返しからなる信号（例えば、矩形信号や鋸波信号）が用いられる。

【００１４】調整作業者は、オシロスコープの波形を観測し、入力波形から波形の中央値Ｄｉを求める。そして、調整作業者は、オシロスコープの波形を観測しながら入力波形の中央値Ｄｉが、ＡＤ変換回路の変換範囲の中央値Ｄと一致するように、ＤＣレベル調整用ボリューム２１ａを回して抵抗値を調整する。さらに、アナログアンプ回路２２から出力される増幅されたアナログＶＧＡ信号の最大値及び最小値が、ＡＤ変換回路２３の変換範囲の最大値及び最小値となるように、アナログアンプ回路２２のゲインを調整する。この調整は、調整作業者が、オシロスコープの波形を観測しながら、ゲイン調整用ボリューム２２ａを回すことによって行う。

【００１５】このようにして、Ｒ，Ｇ，Ｂの各信号に対してアナログアンプ回路２２から出力される増幅されたアナログＶＧＡ信号の最大輝度値D_1+P_1及び最小輝度値D_1-P_1が、ＡＤ変換回路２３のレンジ最大値Ｄ＋Ｐ及びレンジ最小値Ｄ－Ｐに一致するように調整され、スキャンコンバータ４の特性のばらつきによる誤差の補正が行われる。

【００１６】

【発明が解決しようとする課題】しかしながら、上記従来のＬＥＤ表示器制御装置では、調整作業者がオシロスコープの波形を観測しながら、ＤＣレベル調整用ボリューム２１ａ及びゲイン調整用ボリューム２２ａを調整する必要があり、調整作業が面倒なものであった。また、調整作業者は、各ボリュームの調整時に、ＡＤ変換回路２３の変換レンジの範囲Ｄ，Ｄ＋Ｐ，Ｄ－Ｐを記憶しておかねばならないため、調整作業が煩わしく、作業性にも欠けるという問題があった。また、ＤＣレベル調整用ボリューム２１ａ及びゲイン調整用ボリューム２２ａにより調整値を保存しているため、振動により調整値が変化することがあるという問題もあった。さらに、ＡＤ変換回路２３の変換レンジの範囲は、ＡＤ変換回路２３の製造誤差等により装置によって正確に一定とはならず、上記従来の調整手順によっては、ＡＤ変換回路２３の変

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換レンジの範囲のばらつきに対しては、調整することができないという問題もあった。

【００１７】そこで、本発明の課題は、上記従来の問題を解決することにあり、ＤＣレベル及びゲインの調整を容易かつ正確に行うことが可能であり、これらの調整における調整誤差のないＬＥＤ表示器制御装置を提供することにある。

【００１８】

【課題を解決するための手段】上記課題を解決するために本発明のＬＥＤ表示器制御装置は、３原色の各色に対応したアナログ映像信号を、ＬＥＤ表示器で映像を表示させるためのデジタル映像信号に変換するＬＥＤ表示器制御装置であって、前記アナログ映像信号のＤＣレベルを所定のレベルに設定するＤＣ再生部と、前記ＤＣ再生部でＤＣレベルが設定されたアナログ映像信号を所定のゲインで増幅するアナログアンプ部と、前記アナログアンプ部で増幅されたアナログ映像信号を、デジタル映像信号に変換するＡＤ変換部と、前記ＤＣ再生部から出力されるアナログ映像信号の中央レベルが前記ＡＤ変換部のレンジの中央値になるように、前記ＤＣ再生部のＤＣレベルを自動調整するとともに、前記アナログアンプ部から出力されるアナログ映像信号の最大レンジ幅と前記ＡＤ変換部のレンジ幅と等しくなるように、前記アナログアンプ部のゲインを自動調整する自動調整部と、を具備する構成より成る。

【００１９】この構成により、ＤＣレベル及びゲインの調整を容易かつ正確に行うことが可能であり、これらの調整における調整誤差のないＬＥＤ表示器制御装置を提供することができる。

【００２０】

【発明の実施の形態】本発明の請求項１に記載のＬＥＤ表示器制御装置は、３原色の各色に対応したアナログ映像信号を、ＬＥＤ表示器で映像を表示させるためのデジタル映像信号に変換するＬＥＤ表示器制御装置であって、前記アナログ映像信号のＤＣレベルを所定のレベルに設定するＤＣ再生部と、前記ＤＣ再生部でＤＣレベルが設定されたアナログ映像信号を所定のゲインで増幅するアナログアンプ部と、前記アナログアンプ部で増幅されたアナログ映像信号を、デジタル映像信号に変換するＡＤ変換部と、前記ＤＣ再生部から出力されるアナログ映像信号の中央レベルが前記ＡＤ変換部のレンジの中央値になるように、前記ＤＣ再生部のＤＣレベルを自動調整するとともに、前記アナログアンプ部から出力されるアナログ映像信号の最大レンジ幅と前記ＡＤ変換部のレンジ幅と等しくなるように、前記アナログアンプ部のゲインを自動調整する自動調整部と、を具備する構成としたものであり、この構成により、自動調整部がＤＣ再生部のＤＣレベル及び前記アナログアンプ部のゲインを自動調整するため、調整作業者がオシロスコープを用いてＤＣレベルとゲインの調整を行う必要がなくなり、作業が容易となる。また、ボリュームを用いないため、機器の振動によってＤＣレベル及びゲインの設定値が狂うことがない。更に、ＡＤ変換部のアナログ側の変換レンジの個体差によるばらつきに関係なく、正確にＤＣレベル及びゲインの調整が可能となる。

【００２１】請求項２に記載の発明は、請求項１に記載のＬＥＤ表示器制御装置であって、前記自動調整部は、前記アナログ映像信号の最大レベルが前記ＡＤ変換器のレンジの最大値となるように前記ＤＣ再生部のＤＣレベルを設定し、次いで、前記アナログ映像信号の最小レベルが前記ＡＤ変換器のレンジの最小値となるように前記アナログアンプ部のゲインを設定する操作を反復することにより、又は、前記アナログ映像信号の最小レベルが前記ＡＤ変換器のレンジの最小値となるように前記ＤＣ再生部のＤＣレベルを設定し、次いで、前記アナログ映像信号の最大レベルが前記ＡＤ変換器のレンジの最大値となるように前記アナログアンプのゲインを設定する操作を反復することにより、前記ＤＣ再生部のＤＣレベル及び前記アナログアンプ部のゲインを自動調整することとしたものであり、この構成により、自動調整部がＤＣ再生部のＤＣレベル及び前記アナログアンプ部のゲインを自動調整することが可能となる。

【００２２】請求項３に記載の発明は、請求項１に記載のＬＥＤ表示器制御装置であって、前記ＤＣ再生部に入力されるアナログ映像信号を二分し、前記アナログ映像信号のＤＣレベル以上のみ又はＤＣレベル以下のみの部分からなる分割映像信号を生成する波形加工部を備え、前記自動調整部は、前記分割映像信号の最大値又は最小値であるアナログ映像信号の中央レベルと前記ＡＤ変換部のレンジの中央値とが一致するように、前記ＤＣ再生部のＤＣレベルを自動調整した後、前記アナログアンプ部から出力される前記分割映像信号の最小値又は最大値であるアナログ映像信号の最小又は最大レベルと前記ＡＤ変換部のレンジ幅と等しくなるように、前記アナログアンプ部のゲインを自動調整することとしたものであり、この構成により、自動調整部がＤＣ再生部のＤＣレベル及び前記アナログアンプ部のゲインを自動調整することが可能となる。

【００２３】以下に本発明の一実施の形態について、図面を参照しながら説明する。

【００２４】（実施の形態１）図１は本発明の実施の形態１に係るＬＥＤ表示器制御装置のブロック図である。

【００２５】図１において、映像出力装置１は、テレビチューナ、ビデオデッキ、レーザーディスクプレーヤ、ビデオカメラ等の映像出力装置である。信号発生器２は、ＬＥＤ表示器制御装置５のＤＣレベル及びゲイン調整のための調整用信号を生成し出力する。復合分波器３は、方向性結合器により構成される。スキャンコンバータ４は、復合分波器３を通して映像出力装置１又は信号発生器２より入力されるＮＴＳＣ方式の映像信号を色信

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号Ｃと輝度信号Ｙとに分離し、色相、明度、彩度の色調整を行う。色信号Ｃはその後、色差信号Ｒ－Ｙ（Ｕ）、Ｂ－Ｙ（Ｖ）に分離される。これらの信号は、アナログ・デジタル変換（以下「ＡＤ変換」という。）された後に有効表示領域にスケーリングされ、デジタルＲ，Ｇ，Ｂ信号に変換されて最後にアナログ変換してＲ，Ｇ，ＢのアナログＶＧＡ信号として出力される。

【００２６】ＬＥＤ表示器制御装置５は、スキャンコンバータ４から入力されるＲ，Ｇ，ＢのアナログＶＧＡ信号（アナログ映像信号）を、Ｒ，Ｇ，Ｂの各色に対応するデジタル映像信号に変換する。ＬＥＤ表示器６は、多数のＲ，Ｇ，Ｂ各色のＬＥＤが配列された表示装置であり、入力されるＲ，Ｇ，Ｂの各色に対応するデジタル映像信号をフルカラー映像として表示する。

【００２７】ＬＥＤ表示器制御装置５は、ＤＣ再生部８、アナログアンプ部９、ＡＤ変換部１０、信号変換器１１、ＡＤ変換値メモリ１２、自動調整部１３、及び調整値格納メモリ１４から構成されている。ＤＣ再生部８は、スキャンコンバータ４から入力されるアナログＶＧＡ信号のＤＣレベル調整を行うものである。アナログアンプ部９は、ＤＣ再生部８でＤＣレベルの調整が行われたアナログＶＧＡ信号のゲインレベル調整を行うものであり、ＡＧＣ（バリアブル・ゲイン・アンプ）によって、アナログアンプ部９から出力されるアナログＶＧＡ信号のゲイン（増幅率）を可変とすることができる。ＡＤ変換部１０は、ＤＣ再生部８及びアナログアンプ部９によりゲイン調整及びＤＣレベル調整がされたアナログＶＧＡ信号を量子化しデジタルＶＧＡ信号（アナログ映像信号）に変換する。信号変換器１１は、デジタルＶＧＡ信号をＬＥＤ表示器用のＲ，Ｇ，Ｂの各色に対応する表示用デジタル映像信号に変換する。

【００２８】ＡＤ変換値メモリ１２は、ＡＤ変換部１０から出力されるデジタルＶＧＡ信号の値を格納する。自動調整部１３は、ＡＤ変換値メモリ１２に格納されたデジタルＶＧＡ信号の値に基づき、ＤＣ再生部８から出力されるアナログ映像信号の中央レベルをＡＤ変換部１０のレンジの中央値となるように、ＤＣ再生部８のＤＣレベルを自動調整するとともに、アナログアンプ部９から出力されるアナログ映像信号の最大レンジ幅とＡＤ変換部１０のレンジ幅と等しくなるように、アナログアンプ部９のゲインを自動調整する。調整値格納メモリ１４は、自動調整部１３が設定したＤＣ再生部８のＤＣレベル及びアナログアンプ部９のゲインを格納するメモリであり、フラッシュメモリ等の不揮発性メモリが使用される。

【００２９】以上のように構成された本実施の形態のＬＥＤ表示器制御装置において、以下、その動作について説明する。

【００３０】まず、ＤＣ再生部８のＤＣレベル及びアナログアンプ部９のゲインの調整時には、自動調整部１３の動作設定を調整モードとする。次に、信号発生器２から、白色１００％のＮＴＳＣ映像信号を出力させる。該ＮＴＳＣ映像信号は、スキャンコンバータ４によりアナログＶＧＡ信号に変換され、ＬＥＤ表示器制御装置５のＤＣ再生部８に入力される。

【００３１】図２は実施の形態１におけるアナログＶＧＡ信号の誤差の補正方法を説明する図であり、図２（ａ）は誤差補正前の白色１００％のアナログＶＧＡ信号の一例を表す。図２において、D_1+P_1はアナログＶＧＡ信号の最大輝度値、D_1-P_1はアナログＶＧＡ信号の最小輝度値、D_1はアナログＶＧＡ信号の中央値であり、Ｄ＋ＰはＡＤ変換部１０のレンジ最大値、Ｄ－ＰはＡＤ変換部１０のレンジ最小値、ＤはＡＤ変換部１０のレンジ中央値である。

【００３２】白色１００％のアナログＶＧＡ信号は、図２（ａ）に示すように、レベルがD_1+P_1の一定値の信号となる。

【００３３】自動調整部１３は、まず、ＤＣ再生部８のＤＣレベル及びアナログアンプ部９のゲインをデフォルト値に設定する。アナログＶＧＡ信号は、設定されたＤＣレベル及びゲインによって、ＤＣレベル調整と信号増幅がされた後、ＡＤ変換部１０においてＡＤ変換され、この値はＡＤ変換値メモリ１２に格納される。

【００３４】このとき、ＤＣ再生部８に入力されたアナログＶＧＡ信号のレベルD_1+P_1がＡＤ変換器のレンジの最大値Ｄ＋Ｐよりも大きい場合は、ＡＤ変換部１０から出力されるデジタルＶＧＡ信号の値はＡＤ変換器の出力の最大値Ｍ（例えば、ＡＤ変換部１０が８ビットで量子化する場合には、最大値２５５）となり、また、アナログＶＧＡ信号のレベルD_1+P_1がＡＤ変換器のレンジの最大値Ｄ＋Ｐよりも小さい場合は、ＡＤ変換部１０から出力されるデジタルＶＧＡ信号の値はレベルD_1+P_1をＡＤ変換部１０の量子化単位で量子化した値となる。

【００３５】次に、自動調整部１３は、ＡＤ変換値メモリ１２に格納されたデータを読み込む。自動調整部１３は、読み込んだ値がＡＤ変換の出力の最大値Ｍ未満であれば、ＤＣ再生部８のＤＣレベルを上げるように設定し、最終的にＡＤ変換部１０から出力されるデジタルＶＧＡ信号の値がＡＤ変換の出力の最大値ＭとなるまでＤＣ再生部８のＤＣレベルを上昇させる。

【００３６】一方、自動調整部１３は、読み込んだ値がＡＤ変換の出力の最大値Ｍであれば、ＤＣ再生部８のＤＣレベルを下げるように設定し、最終的にＡＤ変換部１０から出力されるデジタルＶＧＡ信号の値がＡＤ変換の出力の最大値Ｍ未満となる手前までＤＣ再生部８のＤＣレベルを下降させる。

【００３７】図２（ｂ）は誤差補正後の白色１００％のアナログＶＧＡ信号を表す。上記調整の終了後は、アナログＶＧＡ信号の最大レベルD_1+P_1はＡＤ変換部１０のレンジの最大値Ｄ＋Ｐと一致する。

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【００３８】次に、信号発生器２からグラデーションパターンのＮＴＳＣ信号を出力させる。該ＮＴＳＣ映像信号は、スキャンコンバータ４によりアナログＶＧＡ信号に変換され、ＬＥＤ表示器制御装置５のＤＣ再生部８に入力される。アナログＶＧＡ信号は、設定されたＤＣレベル及びゲインによって、ＤＣレベル調整と信号増幅がされた後、ＡＤ変換部１０においてＡＤ変換され、この値はＡＤ変換値メモリ１２に格納される。

【００３９】図２（ｃ）は、ゲイン調整前のグラデーションパターンのアナログＶＧＡ信号の一例、図２（ｄ）は、図２（ｃ）のアナログＶＧＡ信号をＡＤ変換した後のデジタルＶＧＡ信号を表す。図のように、アナログアンプ部９のゲインが未調整の場合、アナログＶＧＡ信号の最小値D_1-P_1がＡＤ変換部１０のレンジの最小値Ｄ－Ｐより小さい場合、デジタルＶＧＡ信号にゆがみが生じ、また、アナログＶＧＡ信号の最小値D_1-P_1とＡＤ変換部１０のレンジの最小値Ｄ－Ｐとが一致しないことにより、Ｒ，Ｇ，Ｂの各色の輝度にアンバランスが生じ、正確な色の再現ができない。

【００４０】次に、自動調整部１３は、ＡＤ変換値メモリ１２に格納されたデータを読み込む。自動調整部１３は、読み込んだ値の最小値が０よりも大きい値であれば、アナログアンプ部９のゲインを上げるように設定し、最終的にＡＤ変換部１０から出力されるデジタルＶＧＡ信号の最小値が０となるまでアナログアンプ部９のゲインを上昇させる。

【００４１】一方、自動調整部１３は、読み込んだ値の最小値が０であれば、アナログアンプ部９のゲインを下げるように設定し、最終的にＡＤ変換部１０から出力されるデジタルＶＧＡ信号の値が１以上となる手前までアナログアンプ部９のゲインを下降させる。

【００４２】以上のようなＤＣ再生部８のＤＣレベルの調整とアナログアンプ部９のゲインの自動調整を数回繰り返すことにより、調整は終了する。図２（ｅ）はＤＣ再生部８のＤＣレベルの調整とアナログアンプ部９のゲインのが終了した後のアナログＶＧＡ信号を示す図であり、調整後はアナログＶＧＡ信号の最大値D_1+P_1及びアナログＶＧＡ信号の最小値D_1-P_1が、それぞれ、ＡＤ変換部１０のレンジの最大値Ｄ＋Ｐ及び最小値Ｄ－Ｐと一致する。

【００４３】上記調整が終了した後、自動調整部１３は、調整されたＤＣ再生部８のＤＣレベルとアナログアンプ部９のゲインとを、調整値格納メモリ１４に格納する。そして、実際の映像出力装置１からＮＴＳＣ映像信号を入力する場合には、自動調整部１３の動作設定を非調整モードとし、調整値格納メモリ１４に格納されたＤＣレベル及びゲインをＤＣ再生部８及びアナログアンプ部９に設定してアナログＶＧＡ信号のＤＣレベル変換及び増幅を行うようにする。

【００４４】以上のように、本実施の形態のＬＥＤ表示器制御装置によれば、スキャンコンバータ４の特性によってばらつきがあるＲ，Ｇ，ＢのアナログＶＧＡ信号の調整を自動的に行うことで、ばらつきを抑制することができる。また、Ｒ，Ｇ，Ｂのレベルのばらつきが抑制されたデジタルＶＧＡ信号が信号変換器１１に入力され、ＬＥＤ表示器用のデジタル映像信号に変換され、ＬＥＤ表示器６に映像データが表示されるため、高品質の表示を行うことが可能となる。また、ＤＣ再生部８のＤＣレベルの調整とアナログアンプ部９のゲインの調整にオシロスコープを用いる必要がなく、自動調整部１３が行うため、これらの調整が非常に簡易化され、短時間にこれらの調整を行うことが可能となる。更に、調整されたＤＣレベル及びゲインは、不揮発性メモリである調整値格納メモリ１４に格納され、次回電源起動時も、調整値格納メモリ１４に格納されているこれらの値を読み込んでＤＣ再生部８及びアナログアンプ部９に設定するため、従来のボリュームのように、機器の振動で値が変化することがなく、常時安定して色調にずれのないＬＥＤ表示器の表示制御を行うことが可能となる。更に、ＡＤ変換部の変換レンジの個体差（ばらつき）に関係なく、ＤＣレベル及びゲインの正確な調整が可能となる。

【００４５】なお、本実施の形態においては、自動調整部１３は、まず白色１００％のアナログＶＧＡ信号を用いてＤＣレベルの調整を行い、次にグラデーションパターンのアナログＶＧＡ信号を用いてゲインの調整を行う構成としたが、自動調整部１３は、まず白色１００％のアナログＶＧＡ信号を用いてゲインの調整を行い、次にグラデーションパターンのアナログＶＧＡ信号を用いてＤＣレベルの調整を行う構成としてもよい。このような構成にしても、上述の場合と同様に、自動的にＤＣレベル及びゲインレベルの調整を行うことができる。

【００４６】（実施の形態２）図３は本発明の実施の形態２に係るＬＥＤ表示器制御装置のブロック図である。

【００４７】図３において、１は映像出力装置、２は信号発生器、３は混合分波器、４はスキャンコンバータ、５はＬＥＤ表示器制御装置、６はＬＥＤ表示器、８はＤＣ再生部、９はアナログアンプ部、１０はＡＤ変換部、１１は信号変換器、１２はＡＤ変換値メモリ、１３は自動調整部、１４は調整値格納メモリであり、これらは図１と同様のものであるため、同符号を付して説明は省略する。

【００４８】本実施の形態においては、波形加工部７は入力されるアナログＶＧＡ信号をＤＣレベルで二分割し、アナログＶＧＡ信号のＤＣレベル以下のみの部分からなる分割映像信号を生成する。

【００４９】以上のように構成された本実施の形態のＬＥＤ表示器制御装置において、以下、その動作について説明する。

【００５０】まず、ＤＣ再生部８のＤＣレベル及びアナログアンプ部９のゲインの調整時には、自動調整部１３

の動作設定を調整モードとする。自動調整部１３は、まず、ＤＣ再生部８のＤＣレベル及びアナログアンプ部９のゲインをデフォルト値に設定し、波形加工部７を動作状態とする。次に、信号発生器２から、白黒縞パターンのＮＴＳＣ映像信号を出力させる。該ＮＴＳＣ映像信号は、スキャンコンバータ４によりアナログＶＧＡ信号に変換され、ＬＥＤ表示器制御装置５のＤＣ再生部８に入力される。

【００５１】図４は実施の形態２におけるアナログＶＧＡ信号の誤差の補正方法を説明する図であり、図４（ａ）は誤差補正前の白黒縞パターンのアナログＶＧＡ信号の一例を表す。図４において、D_1+P_1はアナログＶＧＡ信号の最大輝度値、D_1-P_1はアナログＶＧＡ信号の最小輝度値、D_1はアナログＶＧＡ信号の中央値であり、Ｄ＋ＰはＡＤ変換部１０のレンジ最大値、Ｄ－ＰはＡＤ変換部１０のレンジ最小値、ＤはＡＤ変換部１０のレンジ中央値である。

【００５２】白黒縞パターンのアナログＶＧＡ信号は、図４（ａ）に示すように、レベルがD_1+P_1とレベルがD_1-P_1との２準位の繰り返しからなる矩形波信号となる。波形加工部７は、動作状態においては、この入力されるアナログＶＧＡ信号をＤＣレベルで二分割し、アナログＶＧＡ信号のＤＣレベル以下のみの部分からなる分割映像信号を生成する。この分割映像信号は、設定されたＤＣレベル及びゲインによって、ＤＣレベル調整と信号増幅がされた後、ＡＤ変換部１０においてＡＤ変換され、この値はＡＤ変換値メモリ１２に格納される。

【００５３】図４（ｂ）は、波形加工部７により生成されたアナログＶＧＡ信号のＤＣレベル以下のみの部分からなる分割映像信号を表す図である。

【００５４】自動調整部１３は、ＡＤ変換値メモリ１２に格納されたＡＤ変換部１０の出力の最大値ｍを取得し、ＡＤ変換部１０の量子化レンジ中央値Ｍ（例えば、ＡＤ変換部１０が８ビットで量子化する場合には、中央値１２７）と比較する。自動調整部１３は、ＡＤ変換部１０の出力の最大値ｍがＡＤ変換部１０のレンジ中央値Ｍより大きい場合、ＡＤ変換部１０の出力の最大値ｍがＡＤ変換部１０のレンジ中央値Ｍとなるまで、ＤＣ再生部８のＤＣレベルの設定値を下げる。逆に、自動調整部１３は、ＡＤ変換部１０の出力の最大値ｍがＡＤ変換部１０のレンジ中央値Ｍより小さい場合、ＡＤ変換部１０の出力の最大値ｍがＡＤ変換部１０のレンジ中央値Ｍとなるまで、ＤＣ再生部８のＤＣレベルの設定値を上げる。図４（ｃ）は、ＤＣレベルが調整された分割映像信号を表す。

【００５５】このＤＣレベルの調整が終了した後、自動調整部１３は、ＡＤ変換値メモリ１２に格納されたＡＤ変換部１０の出力の最小値ｓを取得する。取得した最小値ｓが０の場合、自動調整部１３は、ＡＤ変換部１０の出力最小値ｓが１以上となるまでゲインレベルを上げた後、１段階だけゲインレベルを下げる。逆に、ＡＤ変換部１０の出力最小値ｓが１以上の場合、自動調整部１３は、ＡＤ変換部１０の出力最小値ｓが０となるまでゲインレベルを下げる。図４（ｄ）は、ゲインが調整された分割映像信号を表す。

【００５６】そして、これらの調整が終了すると、自動調整部１３は、調整されたＤＣ再生部８のＤＣレベルとアナログアンプ部９のゲインとを、調整値格納メモリ１４に格納し、波形加工部７を非動作状態とする。波形加工部７は、非動作状態では入力されるアナログＶＧＡ信号をＤＣレベルで二分割する動作は行わず、入力されたアナログＶＧＡ信号をそのまま出力する（図４（ｅ）参照）。

【００５７】そして、実際の映像出力装置１からＮＴＳＣ映像信号を入力する場合には、自動調整部１３の動作設定を非調整モードとし、調整値格納メモリ１４に格納されたＤＣレベル及びゲインをＤＣ再生部８及びアナログアンプ部９に設定してアナログＶＧＡ信号のＤＣレベル変換及び増幅を行うようにする。

【００５８】なお、本実施の形態では、波形加工部７は、入力されるアナログＶＧＡ信号をＤＣレベルで二分割し、アナログＶＧＡ信号のＤＣレベル以下のみの部分からなる分割映像信号を生成することとしたが、アナログＶＧＡ信号のＤＣレベル以上のみの部分からなる分割映像信号を生成することとしてもよい。

【００５９】

【発明の効果】以上のように本発明の請求項１に記載のＬＥＤ表示器制御装置によれば、３原色の各色に対応したアナログ映像信号を、ＬＥＤ表示器で映像を表示させるためのデジタル映像信号に変換するＬＥＤ表示器制御装置であって、前記アナログ映像信号のＤＣレベルを所定のレベルに設定するＤＣ再生部と、前記ＤＣ再生部でＤＣレベルが設定されたアナログ映像信号を所定のゲインで増幅するアナログアンプ部と、前記アナログアンプ部で増幅されたアナログ映像信号を、デジタル映像信号に変換するＡＤ変換部と、前記ＤＣ再生部から出力されるアナログ映像信号の中央レベルが前記ＡＤ変換部のレンジの中央値になるように、前記ＤＣ再生部のＤＣレベルを自動調整するとともに、前記アナログアンプ部から出力されるアナログ映像信号の最大レンジ幅と前記ＡＤ変換部のレンジ幅と等しくなるように、前記アナログアンプ部のゲインを自動調整する自動調整部と、を具備することにより、ＤＣレベル及びゲインの調整を容易かつ正確に行うことが可能であり、これらの調整における調整誤差のないＬＥＤ表示器制御装置を提供することができる。

【００６０】請求項２に記載の発明によれば、請求項１に記載のＬＥＤ表示器制御装置において、前記自動調整部は、前記アナログ映像信号の最大レベルが前記ＡＤ変換器のレンジの最大値となるように前記ＤＣ再生部のＤ

Ｃレベルを設定し、次いで、前記アナログ映像信号の最小レベルが前記ＡＤ変換器のレンジの最小値となるように前記アナログアンプ部のゲインを設定する操作を反復することにより、又は、前記アナログ映像信号の最小レベルが前記ＡＤ変換器のレンジの最小値となるように前記ＤＣ再生部のＤＣレベルを設定し、次いで、前記アナログ映像信号の最大レベルが前記ＡＤ変換器のレンジの最大値となるように前記アナログアンプのゲインを設定する操作を反復することにより、前記ＤＣ再生部のＤＣレベル及び前記アナログアンプ部のゲインを自動調整することとしたことにより、自動調整部がＤＣ再生部のＤＣレベル及び前記アナログアンプ部のゲインを自動調整することが可能なＬＥＤ表示器制御装置を提供できる。

【００６１】請求項３に記載の発明によれば、請求項１に記載のＬＥＤ表示器制御装置において、前記ＤＣ再生部に入力されるアナログ映像信号を二分し、前記アナログ映像信号のＤＣレベル以上のみ又はＤＣレベル以下のみの部分からなる分割映像信号を生成する波形加工部を備え、前記自動調整部は、前記分割映像信号の最大値又は最小値であるアナログ映像信号の中央レベルと前記ＡＤ変換部のレンジの中央値とが一致するように、前記ＤＣ再生部のＤＣレベルを自動調整した後、前記アナログアンプ部から出力される前記分割映像信号の最小値又は最大値であるアナログ映像信号の最小又は最大レベルと前記ＡＤ変換部のレンジ幅と等しくなるように、前記アナログアンプ部のゲインを自動調整することとしたことにより、自動調整部がＤＣ再生部のＤＣレベル及び前記アナログアンプ部のゲインを自動調整することが可能なＬＥＤ表示器制御装置を提供できる。

【図面の簡単な説明】

【図１】本発明の実施の形態１に係るＬＥＤ表示器制御装置のブロック図

【図２】実施の形態１におけるアナログＶＧＡ信号の誤差の補正方法を説明する図

【図３】本発明の実施の形態２に係るＬＥＤ表示器制御装置のブロック図

【図４】実施の形態２におけるアナログＶＧＡ信号の誤差の補正方法を説明する図

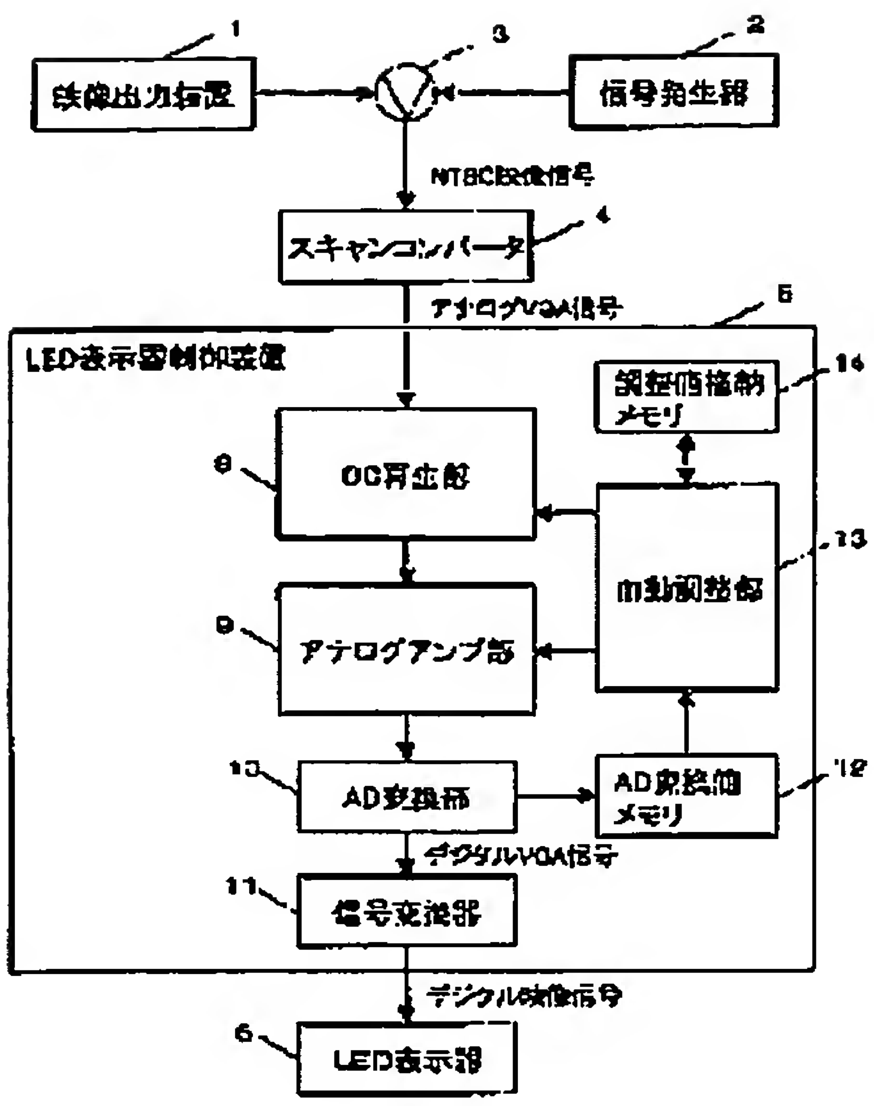
【図５】従来のＬＥＤ表示器制御装置のブロック図

【図６】アナログＶＧＡ信号の誤差の補正方法を説明する図

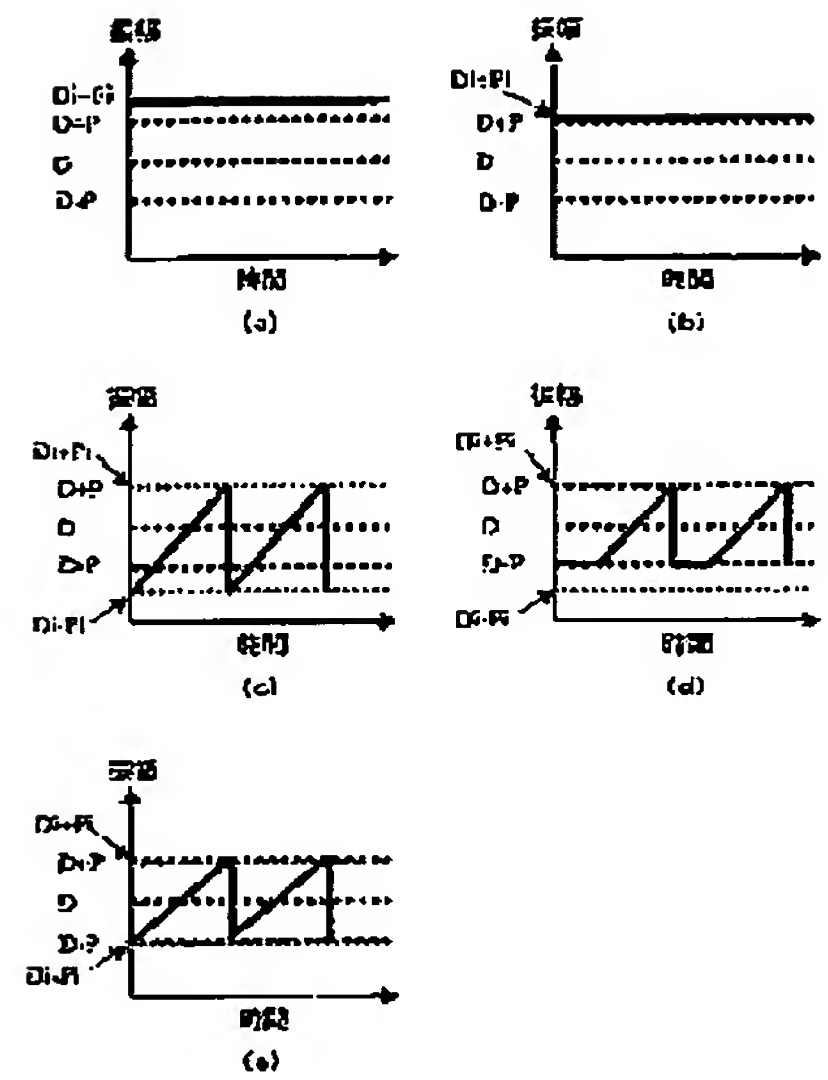
【符号の説明】

１ 映像出力装置
２ 信号発生器
３ 混合分波器
４ スキャンコンバータ
５ ＬＥＤ表示器制御装置
６ ＬＥＤ表示器
７ 波形加工部
８ ＤＣ再生部
９ アナログアンプ部
１０ ＡＤ変換部
１１ 信号変換器
１２ ＡＤ変換値メモリ
１３ 自動調整部
１４ 調整値格納メモリ
２０ ＬＥＤ表示器制御装置
２１ ＤＣ再生回路
２１ａ ＤＣレベル調整用ボリューム
２２ アナログアンプ回路
２２ａ ゲイン調整用ボリューム
２３ ＡＤ変換回路
２４ 信号変換器

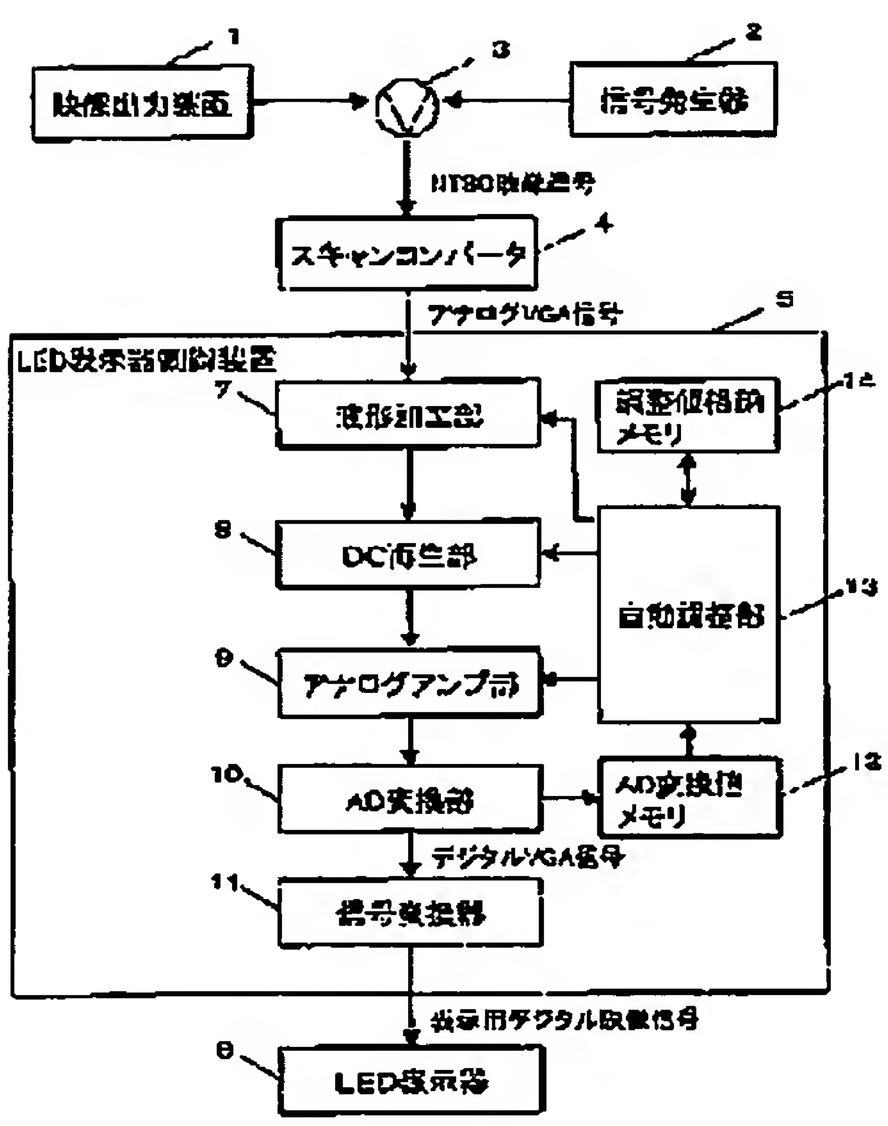
【図１】


映像出力装置
信号発生部
NTSC映像信号
スキャンコンバータ
アナログVGA信号
LED表示器制御装置
調整値格納メモリ
DC再生部
自動調整部
アナログアンプ部
AD変換部
AD変換値メモリ
デジタルVGA信号
信号変換部
デジタル映像信号
LED表示器

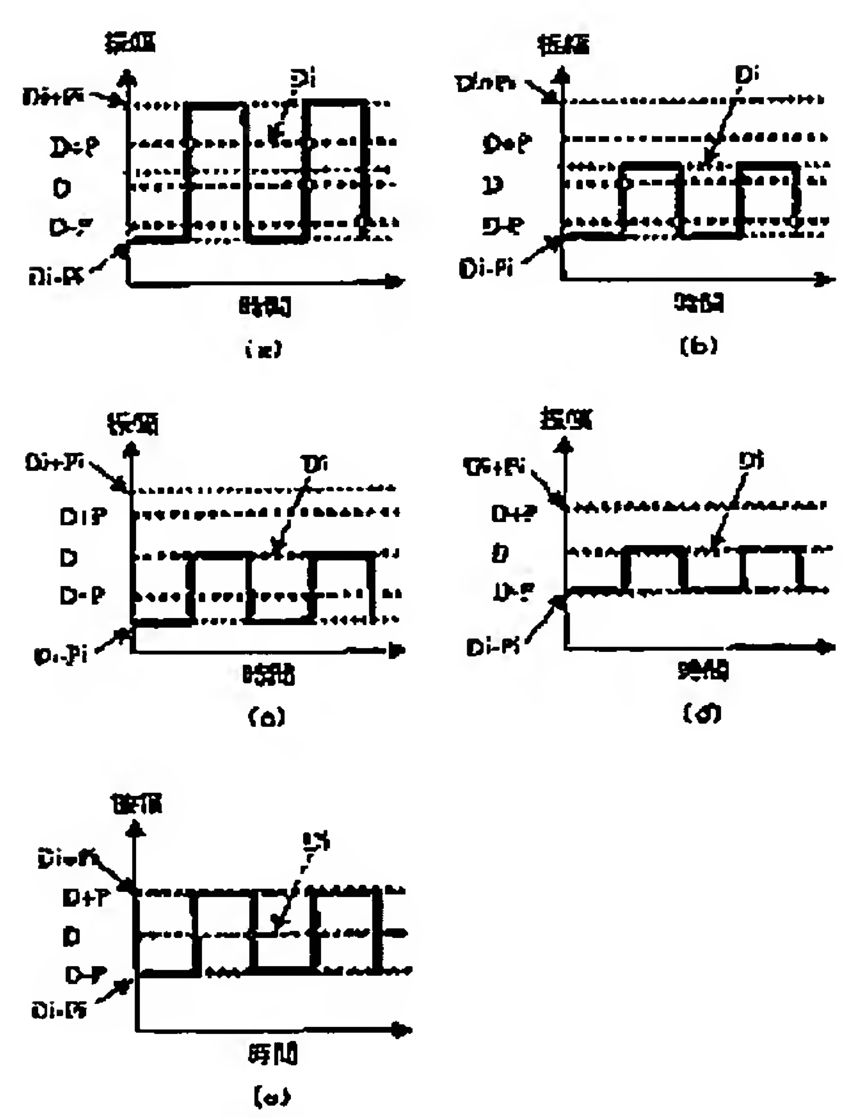
【図２】


振幅
時間
(a)
(b)
(c)
(d)
(e)

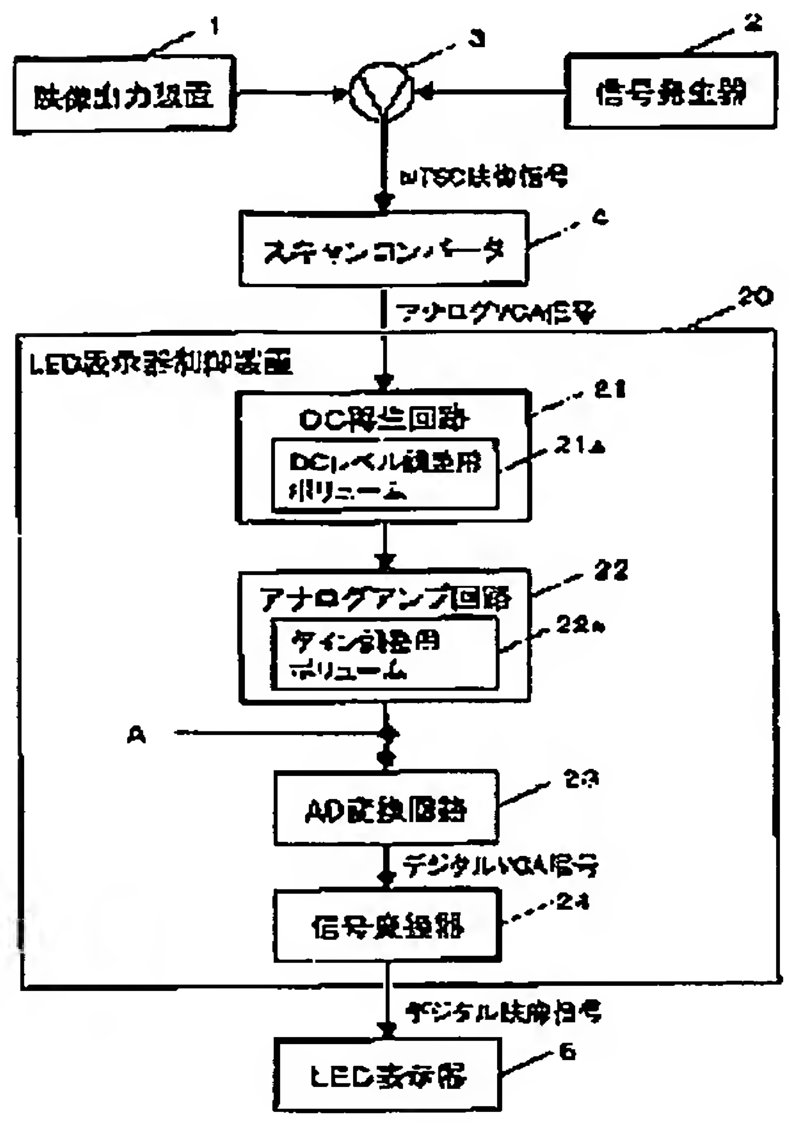
【図３】


映像出力装置
信号発生部
NTSC映像信号
スキャンコンバータ
アナログVGA信号
LED表示器制御装置
波形加工部
調整値格納メモリ
DC再生部
自動調整部
アナログアンプ部
AD変換部
AD変換値メモリ
デジタルVGA信号
信号変換部
表示用デジタル映像信号
LED表示器

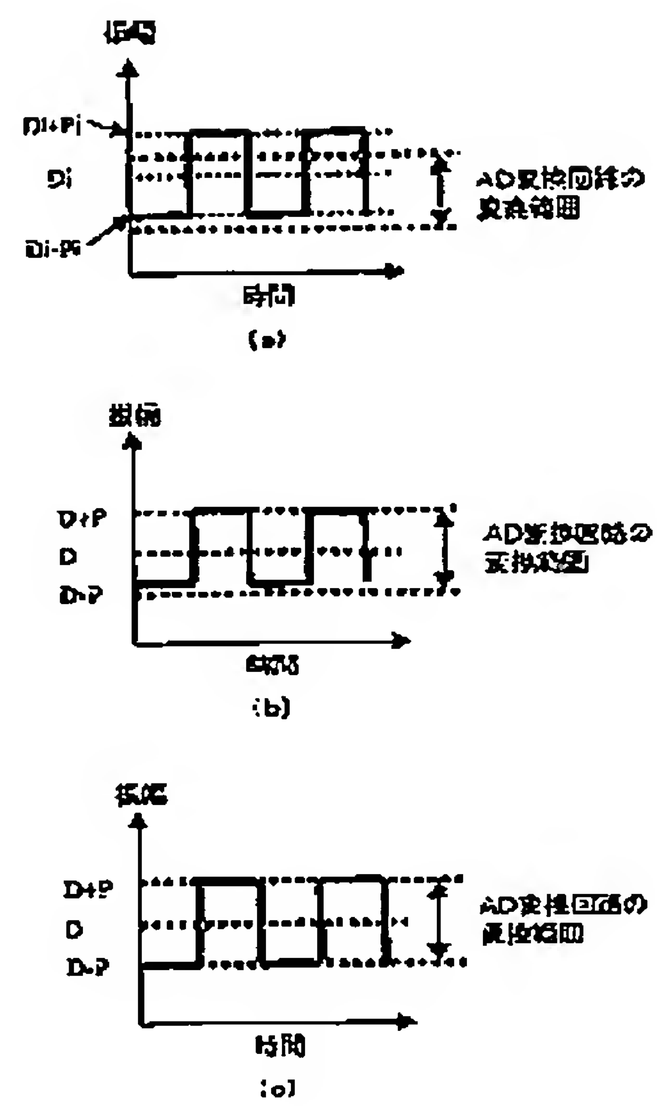
【図４】


振幅
時間
(a)
(b)
(c)
(d)
(e)

【図５】


映像出力装置
信号発生器
NTSC映像信号
スキャンコンバータ
アナログVGA信号
LED表示部制御装置
DC再生回路
DCレベル調整用ボリューム
アナログアンプ回路
ゲイン調整用ボリューム
A
AD変換回路
デジタルVGA信号
信号変換器
デジタル映像信号
LED表示部

【図６】


振幅
Di+Pi
Di
Di-Pi
AD変換回路の変換範囲
時間
(a)
振幅
D+P
D
D-P
AD変換回路の変換範囲
時間
(b)
振幅
D+P
D
D-P
AD変換回路の変換範囲
時間
(c)